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### (54) DRY TONER AND IMAGE FORMING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a dry toner excellent in environmental stability, having no adverse effect on a photoreceptor and an interim transfer body, less liable to cause image deterioration such as fogging and highly applicable to an electrophotographic process.

SOLUTION: The dry toner contains at least a bonding resin, a colorant, a wax component and a polyester resin. This polyester resin comprises polycarboxylic acids and polyols, at least one of the polycarboxylic acids and/or the polyols has an alicyclic structure and the polyester resin is contained in the dry toner by 0.1-50 wt.% of the amount of the toner. In the equivalent circular diameter-circularity scattergram of the toner on number basis measured with a flow type particle image measuring device, the equivalent circular number average diameter D1 of the dry toner is 2-10  $\mu\text{m}$ , the average circularity of the toner is 0.950-0.995 and the standard deviation of circularity is <0.040.

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CLAIMS

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[Claim(s)]

[Claim 1] In binding resin, a coloring agent, a wax component, and the dry type toner that contains polyester system resin at least this polyester system resin Consist of multiple-valued carboxylic acids and polyhydric alcohol, and it has alicyclic structure in at least one of a multiple-valued carboxylic acid and/or the polyhydric alcohol. In the projected area diameter-circularity scatter diagram of the number criteria of the toner which contains this polyester system resin 0.1 to 50% of the weight on the basis of this toner in said dry type toner, and is measured with the flow type particle image measuring device of this toner The dry type toner which the circle equivalent number pitch diameter D1 (micrometer) of this dry type toner is 2-10 micrometers, and is characterized by whenever [ mean circle form / of this toner ] being [ circularity standard deviation ] less than 0.040 in 0.950-0.995.

[Claim 2] This toner is a dry type toner according to claim 1 characterized by containing the with a molecular weight of 1000 or less which has the repeat unit of this polyester system resin in structure component 10.0 or less % of the weight on the basis of this toner in the molecular weight distribution by the gel permeation chromatography (GPC) in tetrahydrofuran (THF) extractives.

[Claim 3] This polyester system resin is a dry type toner according to claim 1 or 2 characterized by not containing an oxyethylene chain and an oxypropylene chain in a molecule.

[Claim 4] The dry type toner according to claim 1 to 3 characterized by this polyester system resin not containing a ring.

[Claim 5] The dry type toner according to claim 1 to 4 characterized by the acid numbers of said polyester system resin being 0.01 - 20mgKOH / 1g of resin.

[Claim 6] The dry type toner according to claim 1 to 5 with which said polyester system resin is characterized by containing 0.1 to 30% of the weight to this toner AUW.

[Claim 7] The dry type toner according to claim 1 to 6 with which the content of the alicyclic frame contained in this polyester system resin is characterized by being 0.1 - 10 % of the weight to this toner AUW.

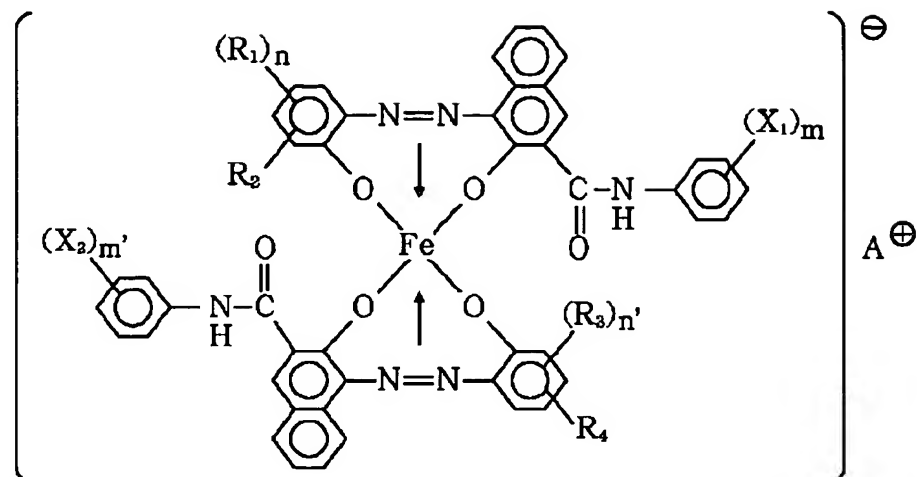
[Claim 8] This polyester system resin is a dry type toner according to claim 1 to 7 with which peak molecular weight is characterized by being within the limits of 1000-500000 in the molecular weight distribution by GPC.

[Claim 9] This polyester system resin is a dry type toner according to claim 1 to 8 with which peak molecular weight is characterized by being within the limits of 2000-100000 in the molecular weight distribution by GPC.

[Claim 10] The dry type toner according to claim 1 to 9 characterized by containing at least one or more electrification control agents shown in the following general formula (I).

[Formula 1]

## 一般式 (I)



[式中、 $X_1$ および $X_2$ は水素原子、低級アルキル基、低級アルコキシ基、ニトロ基及びハロゲン原子からなるグループから選択されるメンバーを表示し、 $X_1$ と $X_2$ は同じ又は異なっており、 $m$ および $m'$ は1～3の整数を表示し、 $R_1$ および $R_3$ は水素原子、 $C_1 \sim C_{18}$ のアルキル基、 $C_2 \sim C_{18}$ のアルケニル基、スルホンアミド基、メシル基、スルホン酸基、ヒドロキシ基、 $C_1 \sim C_{18}$ のアルコキシ基、アセチルアミノ基、ベンゾイルアミノ基及びハロゲン原子又は $-\text{C}(=\text{O})-\text{O}-\text{R}_6$ からなるグループから選択されるメンバーを表示し、 $R_1$

と $R_3$ は同じ又は異なっており、 $n$ および $n'$ は1～3の整数を表示し、 $R_2$ および $R_4$ は水素原子またはニトロ基を表示し、 $R_6$ はアルキル基又はアリール基を表示し、 $A^+$ はアンモニウムイオン、水素イオン、ナトリウムイオン及びカリウムイオンからなるグループから選択されるカチオンイオンを示す。]

[Claim 11] The dry type toner according to claim 1 to 10 with which whenever [ mean circle form / of this toner ] is characterized by circularity standard deviation being less than 0.035 by 0.970-0.995.

[Claim 12] The dry type toner according to claim 1 to 11 with which a less than 0.950 circularity toner particle is characterized by 15-piece being several % or less by this toner in the projected area diameter-circularity scatter diagram of the number criteria of the toner measured with said flow type particle image measuring device.

[Claim 13] The electrification process which impresses an electrical potential difference to an electrification member, and is charged from the exterior to electrostatic latent-image support at least, The latent-image formation process which forms an electrostatic latent image in the electrostatic electrified latent-image support, and the development process which develops an electrostatic-charge image with a toner and forms a toner image on electrostatic latent-image support, In the image formation approach of having the imprint process which imprints the toner image on electrostatic latent-image support to imprint material, and the fixation process which carries out heating fixation of the toner image on imprint material this toner They are binding resin, a coloring agent, a wax component, and the

dry type toner that contains polyester system resin at least. This polyester system resin Consist of multiple-valued carboxylic acids and polyhydric alcohol, and it has alicyclic structure in at least one of a multiple-valued carboxylic acid and/or the polyhydric alcohol. In the projected area diameter-circularity scatter diagram of the number criteria of the toner which contains this polyester system resin 0.1 to 50% of the weight on the basis of this toner in said dry type toner, and is measured with the flow type particle image measuring device of this toner The image formation approach which the circle equivalent number pitch diameter D1 (micrometer) of this dry type toner is 2-10 micrometers, and is characterized by whenever [ mean circle form / of this toner ] being [ circularity standard deviation ] less than 0.040 in 0.950-0.995.

[Claim 14] This toner is the image formation approach according to claim 13 characterized by containing the with a molecular weight of 1000 or less which has the repeat unit of this polyester system resin in structure component 10.0 or less % of the weight on the basis of this toner in the molecular weight distribution by the gel permeation chromatography (GPC) in tetrahydrofuran (THF) extractives.

[Claim 15] This polyester system resin is the image formation approach according to claim 13 or 14 characterized by not containing an oxyethylene chain and an oxypropylene chain in a molecule.

[Claim 16] The image formation approach according to claim 13 to 15 characterized by this polyester system resin not containing a ring.

[Claim 17] The image formation approach according to claim 13 to 16 characterized by the acid numbers of said polyester system resin being 0.01 - 20mgKOH / 1g of resin.

[Claim 18] The image formation approach according to claim 13 to 17 that said polyester system resin is characterized by being 0.1 - 30 % of the weight to this toner AUW.

[Claim 19] The image formation approach according to claim 13 to 18 that the content of the alicyclic frame contained in this polyester system resin is characterized by being 0.1 - 10 % of the weight to this toner AUW.

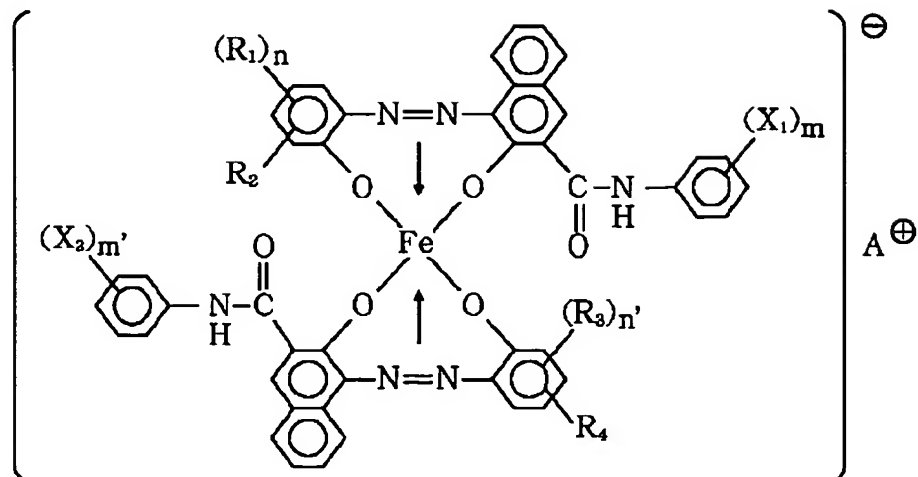
[Claim 20] This polyester system resin is the image formation approach according to claim 13 to 19 that peak molecular weight is characterized by being within the limits of 1000-500000 in the molecular weight distribution by GPC.

[Claim 21] This polyester system resin is the image formation approach according to claim 13 to 20 that peak molecular weight is characterized by being within the limits of 2000-100000 in the molecular weight distribution by GPC.

[Claim 22] The image formation approach according to claim 13 to 21 characterized by containing at least one or more electrification control agents shown in the following general formula (I).

[Formula 2]

一般式 (I)



[式中、 $X_1$ および $X_2$ は水素原子、低級アルキル基、低級アルコキシ基、ニトロ基及びハロゲン原子からなるグループから選択されるメンバーを表示し、 $X_1$ と $X_2$ は同じ又は異なっており、 $m$ および $m'$ は1～3の整数を表示し、 $R_1$ および $R_3$ は水素原子、 $C_1 \sim C_{18}$ のアルキル基、 $C_2 \sim C_{18}$ のアルケニル基、スルホンアミド基、メシル基、スルホン酸基、ヒドロキシ基、 $C_1 \sim C_{18}$ のアルコキシ基、アセチルアミノ基、ベンゾイルアミノ基及びハロゲン原子又は $-\text{C}(=\text{O})-\text{O}-\text{R}_5$ からなるグループから選択されるメンバーを表示し、 $R_1$

と $R_3$ は同じ又は異なっており、 $n$ および $n'$ は1～3の整数を表示し、 $R_2$ および $R_4$ は水素原子またはニトロ基を表示し、 $R_5$ はアルキル基又はアリール基を表示し、 $A^+$ はアンモニウムイオン、水素イオン、ナトリウムイオン及びカリウムイオンからなるグループから選択されるカチオンイオンを示す。]

[Claim 23] The image formation approach according to claim 13 to 22 that whenever [ mean circle form / of this toner ] is characterized by circularity standard deviation being less than 0.035 by 0.970-0.995.

[Claim 24] The image formation approach according to claim 13 to 23 that a less than 0.950 circularity toner particle is characterized by 15-piece being several % or less by this toner in the projected area diameter-circularity scatter diagram of the number criteria of the toner measured with said flow type particle image measuring device.

[Claim 25] The image formation approach according to claim 13 to 24 characterized by for the passing speed of the toner support side in a development field being 1.05 to 3.0 times the rate of this to the passing speed of an electrostatic latent-image support side, and the surface roughness Ra of this toner support (micrometer) being 1.5 or less in this development process.

[Claim 26] The image formation approach according to claim 13 to 25 characterized by countering with this toner support and allotting a ferromagnetic metal blade with minute spacing.

[Claim 27] The image formation approach according to claim 13 to 25 characterized by contacting the

blade which counters with this toner support and consists of an elastic body.

[Claim 28] The image formation approach according to claim 13 to 27 characterized by developing negatives, having a fixed gap with this electrostatic latent-image support and toner support, and impressing mutual electric field.

[Claim 29] The image formation approach according to claim 13 to 28 that this electrification process is characterized by contacting an electrification member to electrostatic latent-image support, impressing an electrical potential difference to an electrification member from the exterior, and charging electrostatic latent-image support.

[Claim 30] The image formation approach according to claim 13 to 29 characterized by this electrostatic latent-image support and imprint equipment contacting through this imprint material in the case of the imprint process which carries out electrostatic image transfer of the toner image on this electrostatic latent-image support to imprint material using imprint equipment.

[Claim 31] The image formation approach according to claim 13 to 30 that this heating fixation process does not have supply of the liquid for offset prevention, or is characterized by carrying out heating fixation of the toner image at imprint material with the heating anchorage device which does not have a fixing assembly cleaner.

[Claim 32] The image formation approach given in either of claim 13 \*\* 30 to which this heating fixation process is characterized by carrying out heating fixation of the toner image at imprint material by the application-of-pressure member which carries out an opposite pressure welding to the heating object by which fixed support was carried out, and this heating object and, which is stuck on this heating object through a film.

[Claim 33] The image formation approach according to claim 13 to 32 characterized by having the toner reuse device in which supply this toner that cleaned, collected and collected the residual toners which are not imprinted on the electrostatic latent-image support after an imprint to a development means, make a development means hold again, and the electrostatic latent image on electrostatic latent-image support is developed.

[Claim 34] The electrification process which impresses an electrical potential difference to an electrification member, and is charged from the exterior to electrostatic latent-image support at least, The latent-image formation process which forms an electrostatic latent image in the electrostatic electrified latent-image support, and the development process which develops an electrostatic-charge image with a toner and forms a toner image on electrostatic latent-image support, In the image formation approach of having the 1st imprint process which imprints the toner image on electrostatic latent-image support on a medium imprint object, the 2nd imprint process which imprints the toner image on this medium imprint object to imprint material, and the fixation process which carries out heating fixation of the toner image on imprint material These toners are binding resin, a coloring agent, a wax component, and a dry type toner that contains polyester system resin at least. This polyester system resin Consist of multiple-valued carboxylic acids and polyhydric alcohol, and it has alicyclic structure in at least one of a multiple-valued carboxylic acid and/or the polyhydric alcohol. In the projected area diameter-circularity scatter diagram of the number criteria of the toner which contains this polyester system resin 0.1 to 50% of the weight on the basis of this toner in said dry type toner, and is measured with the flow type particle image measuring device of this toner The image formation approach which the circle equivalent number pitch diameter D1 (micrometer) of this dry type toner is 2-10 micrometers, and is characterized by whenever [ mean circle form / of this toner ] being [ circularity standard deviation ] less than 0.040 in 0.950-0.995.

[Claim 35] This toner is the image formation approach according to claim 34 characterized by containing the with a molecular weight of 1000 or less which has the repeat unit of this polyester system resin in structure component 10.0 or less % of the weight on the basis of this toner in the molecular weight distribution by the gel permeation chromatography (GPC) in tetrahydrofuran (THF) extractives.

[Claim 36] This polyester system resin is the image formation approach according to claim 34 or 35 characterized by not containing an oxyethylene chain and an oxypropylene chain in a molecule.

[Claim 37] The image formation approach according to claim 34 to 36 characterized by this polyester

system resin not containing a ring.

[Claim 38] The image formation approach according to claim 34 to 37 characterized by the acid numbers of said polyester system resin being 0.01 - 20mgKOH / 1g of resin.

[Claim 39] The image formation approach according to claim 34 to 38 that said polyester system resin is characterized by being 0.1 - 30 % of the weight to this toner AUW.

[Claim 40] The image formation approach according to claim 34 to 39 that the content of the alicyclic frame contained in this polyester system resin is characterized by being 0.1 - 10 % of the weight to this toner AUW.

[Claim 41] This polyester system resin is the image formation approach according to claim 34 to 40 that peak molecular weight is characterized by being within the limits of 1000-500000 in the molecular weight distribution by GPC.

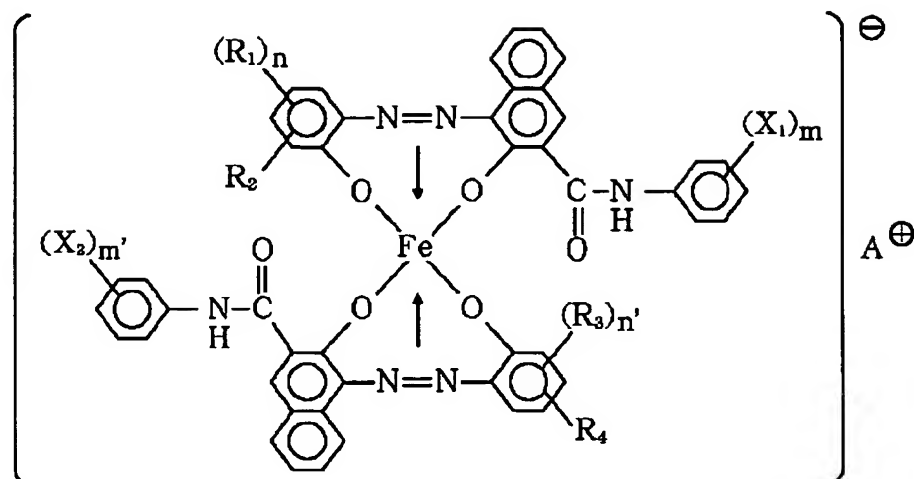
[Claim 42] This polyester system resin is the image formation approach according to claim 34 to 40 that peak molecular weight is characterized by being within the limits of 2000-100000 in the molecular weight distribution by GPC.

[Claim 43] The image formation approach according to claim 34 to 42 characterized by containing at least one or more electrification control agents shown in the following general formula (I).

[Formula 3]



## 一般式 (I)



[式中、 $X_1$ および $X_2$ は水素原子、低級アルキル基、低級アルコキシ基、ニトロ基及びハロゲン原子からなるグループから選択されるメンバーを表示し、 $X_1$ と $X_2$ は同じ又は異なっており、 $m$ および $m'$ は1～3の整数を表示し、 $R_1$ および $R_3$ は水素原子、 $C_1 \sim C_{18}$ のアルキル基、 $C_2 \sim C_{18}$ のアルケニル基、スルホンアミド基、メシル基、スルホン酸基、ヒドロキシ基、 $C_1 \sim C_{18}$ のアルコキシ基、アセチルアミノ基、ベンゾイルアミノ基及びハロゲン原子又は $-\text{C}(=\text{O})-\text{O}-\text{R}_5$ からなるグループから選択されるメンバーを表示し、 $R_1$

と $R_3$ は同じ又は異なっており、 $n$ および $n'$ は1～3の整数を表示し、 $R_2$ および $R_4$ は水素原子またはニトロ基を表示し、 $R_5$ はアルキル基又はアリール基を表示し、 $A^+$ はアンモニウムイオン、水素イオン、ナトリウムイオン及びカリウムイオンからなるグループから選択されるカチオンイオンを示す。]

[Claim 44] The image formation approach according to claim 34 to 43 that whenever [ mean circle form / of this toner ] is characterized by circularity standard deviation being less than 0.035 by 0.970-0.995.

[Claim 45] The image formation approach according to claim 34 to 44 that a less than 0.950 circularity toner particle is characterized by 15-piece being several % or less by this toner in the projected area diameter-circularity scatter diagram of the number criteria of the toner measured with said flow type particle image measuring device.

[Claim 46] The image formation approach according to claim 34 to 43 characterized by for the passing speed of the toner support side in a development field being 1.05 to 3.0 times the rate of this to the passing speed of an electrostatic latent-image support side, and the surface roughness Ra of this toner support (micrometer) being 1.5 or less in this development process.

[Claim 47] The image formation approach according to claim 34 to 46 characterized by countering with this toner support and allotting a ferromagnetic metal blade with minute spacing.

[Claim 48] The image formation approach according to claim 34 to 46 characterized by contacting the

blade which counters with this toner support and consists of an elastic body.

[Claim 49] The image formation approach according to claim 34 to 48 characterized by developing negatives, having a fixed gap with this electrostatic latent-image support and toner support, and impressing mutual electric field.

[Claim 50] The image formation approach according to claim 34 to 49 that this electrification process is characterized by contacting an electrification member to electrostatic latent-image support, impressing an electrical potential difference to an electrification member from the exterior, and charging electrostatic latent-image support.

[Claim 51] The image formation approach according to claim 34 to 50 characterized by this medium imprint object and imprint equipment contacting through this imprint material in the case of the 2nd imprint process which carries out electrostatic image transfer of the toner image on this medium imprint object to imprint material using imprint equipment.

[Claim 52] The image formation approach according to claim 34 to 51 that this heating fixation process does not have supply of the liquid for offset prevention, or is characterized by carrying out heating fixation of the toner image at record material with the heating anchorage device which does not have a fixing assembly cleaner.

[Claim 53] The image formation approach according to claim 34 to 51 that this heating fixation process is characterized by carrying out heating fixation of the toner image at record material by the application-of-pressure member which carries out an opposite pressure welding to the heating object by which fixed support was carried out, and this heating object and which is stuck on this heating object through a film.

[Claim 54] The image formation approach according to claim 34 to 53 characterized by having the toner reuse device in which supply this toner that cleaned, collected and collected the residual toners which are not imprinted on the electrostatic latent-image support after an imprint to a development means, make a development means hold again, and the electrostatic latent image on electrostatic latent-image support is developed.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]****[0001]**

**[Field of the Invention]** This invention relates to the image formation approach using the dry type toner (a toner is called below) used for the record approach using a xerography, an electrostatic recording method, magnetic recording, a toner jet process, etc., and this toner. It is related with the image formation approach using the toner used for the image recording equipment which can be used for a copying machine, a printer, facsimile, a plotter, etc. in detail, and this toner. Especially, in order to show good electrification nature, it excels also in the stability of image quality, and it not only excels in image quality, but it excels also in environmental stability and the contamination to a developer support member, a photo conductor, an imprint roller, a fixing assembly, etc. is related with few toners and the image formation approach, so that image concentration is high and there are few fogging and transfer residues.

**[0002]**

**[Description of the Prior Art]** The approach of a large number which are indicated by a U.S. Pat. No. 2,297,691 description, JP,42-23910,B, and JP,43-24748,B as electrophotographic technology is learned. After using the photoconductivity matter generally, forming an electrostatic-charge latent image on a photo conductor with various means, developing this electrostatic-charge latent image using a toner subsequently and imprinting a toner image to imprint material, such as paper and a film, if needed, it is established with heating, a pressure, heating application of pressure, or a solvent steam, and a toner image is obtained.

**[0003]** As an approach of visualizing an electrostatic-charge latent image, the cascade developing-negatives method, the magnetic brush developing-negatives method, the application-of-pressure development approach, etc. are learned. Furthermore, the method of making the between on a photo conductor and a sleeve fly in electric field using the revolution sleeve which allotted the magnetic pole to the core is also used using the magnetic toner.

**[0004]** Like 2 component methods, since the carrier particles, such as a glass bead and iron powder, are unnecessary, a 1 component development method can carry out [ a miniaturization and lightweight ]-izing of the developer itself. Furthermore, since a 2 component development method needs to keep the concentration of the toner in a carrier constant, the equipment which detects toner concentration and supplies the toner of an initial complement is required for it. Therefore, a developer becomes heavy greatly also here. Since such equipment is not needed and it can do lightly small too in a 1 component development method, it is desirable.

**[0005]** Moreover, as for printer equipment, that LBP or an LED printer had become the mainstream of the latest commercial scene, and was [ that ] 300,600dpi extent high resolution, i.e., conventionally, as a direction of technical is being set to 1200 and 2400dpi. Therefore, in connection with this, the high definition has been required more also for the development method. Moreover, advanced features are progressing also in the copying machine, therefore it is progressing towards digitization. Since this direction has the main approach of forming an electrostatic-charge image by laser, it is progressing in

the high resolution direction too, and high resolving and a high definition development method have been required like a printer also here.

[0006] In order to attain high resolution and a high definition, it is required that a toner should be diameter[ of a granule ]-ized. However, the control becomes important, in order for the variation in the electrification nature of a toner particle to become large and to attain said object, if a toner is diameter [ of a granule ]-ized.

[0007] For example, in patent No. 2632251, the toner which made specific carbon black adhere to the front face of a toner particle whose mean particle diameter manufactured by the polymerization method is 3-8 micrometers is proposed. Since the carbon black adhering to a particle front face will drop out and the electrification nature of a toner will be sharply changed if \*\*\*\* number of sheets exceeds near 5000 sheet when an image is outputted to such a particle front face using the toner which has arranged the ingredient which controls electrification nature, electrification stability will become imperfection.

[0008] Moreover, JP,5-94042,A, JP,6-19197,A, etc. are mentioned as a proposal which controls the environmental stability of electrification nature from Men of an ingredient. However, these are still inadequate level in fogging or a transfer residue, when image assessment is performed actually.

[0009] The actual condition is that there is no toner with which it is satisfied of the environmental stability of high resolution, a high definition, and electrification nature as mentioned above.

[0010]

[Problem(s) to be Solved by the Invention] The object of this invention gives a high definition image with high resolution, and offers the image formation approach using the toner with which are satisfied of the environmental stability of electrification nature, and this toner.

[0011]

[Means for Solving the Problem] When this invention persons considered the effect the particle-size frequency distribution and circularity frequency distribution of a toner particle affect development nature and imprint nature, they resulted that there was very deep relation in a header and this invention.

[0012] In the dry type toner with which this invention contains binding resin, a coloring agent, a wax component, and polyester system resin at least namely, this polyester system resin Consist of multiple-valued carboxylic acids and polyhydric alcohol, and it has alicyclic structure in at least one of a multiple-valued carboxylic acid and/or the polyhydric alcohol. In the projected area diameter-circularity scatter diagram of the number criteria of the toner which contains this polyester system resin 0.1 to 50% of the weight on the basis of this toner in said dry type toner, and is measured with the flow type particle image measuring device of this toner It is related with the dry type toner which the circle equivalent number pitch diameter D1 (micrometer) of this dry type toner is 2-10 micrometers, and is characterized by whenever [ mean circle form / of this toner ] being [ circularity standard deviation ] less than 0.040 in 0.950-0.995.

[0013] Moreover, the electrification process which this invention impresses an electrical potential difference to an electrification member from the exterior at least, and is charged to electrostatic latent-image support, The latent-image formation process which forms an electrostatic latent image in the electrostatic electrified latent-image support, and the development process which develops an electrostatic-charge image with a toner and forms a toner image on electrostatic latent-image support, In the image formation approach of having the imprint process which imprints the toner image on electrostatic latent-image support to imprint material, and the fixation process which carries out heating fixation of the toner image on imprint material, it is related with the image formation approach characterized by using the toner of the above-mentioned configuration as this toner.

[0014] Furthermore, the electrification process which this invention impresses an electrical potential difference to an electrification member from the exterior at least, and is charged to electrostatic latent-image support, The latent-image formation process which forms an electrostatic latent image in the electrostatic electrified latent-image support, and the development process which develops an electrostatic-charge image with a toner and forms a toner image on electrostatic latent-image support, In the image formation approach of having the 1st imprint process which imprints the toner image on electrostatic latent-image support on a medium imprint object, the 2nd imprint process which imprints

the toner image on this medium imprint object to imprint material, and the fixation process which carries out heating fixation of the toner image on imprint material. It is related with the image formation approach characterized by using the toner of the above-mentioned configuration as this toner.

[0015]

[Embodiment of the Invention] It is indispensable that binding resin, a coloring agent, a wax component, and polyester system resin are contained in the toner of this invention, and it must contain alicyclic structure in at least one of the multiple-valued carboxylic acid which constitutes this polyester system resin, and/or the polyhydric alcohol.

[0016] As the reason, by having alicyclic structure, the water absorption of a toner falls, as a result, the standup of electrification of a toner becomes early, and it is possible that the environmental stability of electrification nature improves further.

[0017] In the case of a six membered ring, alicyclic structure has the conformation of a chair mold, and the stable conformation of twist-boat form in potential energy, and, usually structure with the same said of the ring of the other numbers is taken. On the other hand, in the case of ring structure, the planar structure is taken.

[0018] The structural difference among these both appears also as a phenomenon of the ease of carrying out of adsorption of the water molecule for the ester base which combines a principal chain. In order to consider as the environment with which the carbon atom which constitutes a ring from alicyclic structure was [ each other ] comparatively crowded in the surroundings of an ester group, to a ring frame functioning as steric hindrance to a water molecule, and adsorption of a water molecule being checked comparatively, with ring structure, a ring frame hardly functions as steric hindrance, but there is no big effectiveness to adsorption inhibition of a water molecule.

[0019] As a multiple-valued carboxylic-acid component which has alicyclic structure among the monomers which constitute this polyester system resin, such low-grade alkyl ester, such as 1, 2-cyclohexane dicarboxylic acid, 1, 3-cyclohexane dicarboxylic acid, 1, 4-cyclohexane dicarboxylic acid, 1 and 2, 4-cyclohexane tricarboxylic acid, 1 and 3, 5-cyclohexane tricarboxylic acid, tetrahydro phthalic anhydride, and hexahydro phthalic anhydride, etc. is mentioned.

[0020] Moreover, as a polyhydric-alcohol component which has the same alicyclic structure, the ethyleneoxide addition product of 1, 2-cyclohexane diol, 1, 3-cyclohexane diol, 1, 4-cyclohexane diols and these derivatives, 1, 4-cyclohexane dimethanol, spiroglycol, tricyclodecane diol, tricyclodecane dimethanol, 1 and 3, 5-cyclohexane TORIMETA Norian, hydrogenation bisphenol A, and hydrogenation bisphenol A, a propylene oxide addition product, etc. are mentioned.

[0021] These multiple-valued carboxylic acids, polyhydric alcohol, and its derivative may be used independently, and may be used by the mixed state.

[0022] Moreover, as a carboxylic-acid component of many \*\*, the low-grade alkyl ester of dicarboxylic acid, such as dicarboxylic acid anhydride; dimethyl terephthalates, such as dicarboxylic acid; phthalic anhydride, such as naphthalene dicarboxylic acid, a phthalic acid, isophthalic acid, a terephthalic acid, a maleic acid, a fumaric acid, a citraconic acid, an itaconic acid, a succinic acid, an adipic acid, a sebacic acid, and an azelaic acid, and a maleic anhydride, maleic-acid dimethyl, and adipic-acid dimethyl, etc. can be mentioned among the comonomers which do not have the alicyclic structure which constitutes this polyester system resin. Aromatic series dicarboxylic acid, such as a phthalic acid, isophthalic acid, and a terephthalic acid, or the derivative of those is suitable for especially the principal component. In addition, the little activity of 1,2,4-benzenetricarboxylic acid, 2 and 5, 7-naphthalene tricarboxylic acid, its anhydride, or those low-grade alkyl ester of extent which does not generate a gel object etc. may be carried out at the polyester used for this invention.

[0023] These multiple-valued carboxylic acid and its derivative may be used independently, and may be used by the mixed state.

[0024] As alcohol of many \*\*, diol compounds, such as ethylene glycol, propylene glycol, 1,4-butanediol, 1,3-butanediol, 2, 3-butanediol, diethylene-glycol, dipropylene glycol, triethylene glycol, 1,5-pentanediol, 1,6-hexanediol, neopentyl glycol, 2,2,4-trimethylpentane -1, 3-diol, 2, and 2-JI (4-hydroxy ethoxy phenyl) propane, 2, and 2-JI (4-hydroxy propoxy phenyl) propane, can be mentioned.

These polyhydric alcohol may be used independently and may be used by the mixed state.

[0025] Especially the manufacture approach of the polyester system resin of this invention is not limited, but well-known various approaches can adopt it conventionally. Usually, heating temperature up of the monomer is taught and carried out to a reaction vessel, and an esterification reaction or an ester exchange reaction is performed. The following manufacture approaches are mentioned preferably. Monomers other than a multifunctional compound are taught to polymerization tubing, an esterification reaction or an ester exchange reaction is performed in 150-220 degrees C under an inert atmosphere, and the water or alcohol produced at this reaction is removed. It decompresses to 0.1 - 100mmHg after that, and a prepolymer is obtained. This prepolymer is decompressed to 0.1 - 100mmHg in 180-28 degrees C according to a conventional method with a multifunctional compound, and a polycondensation is performed, and when it becomes predetermined viscosity, it extracts. In addition, all the acid component:alcoholic components of 1:1.1 to 1:1.8 are [ the mole ratio of the preparation which totaled the whole reaction of all acid components and all alcoholic components ] desirable. As a catalyst for promoting a reaction, a sulfuric acid, dibutyl tin oxide, a zinc oxide, a dibutyl tin JIURA rate, titanium butoxide, magnesium acetate, manganese acetate, acetic-acid tin, zinc acetate, 2 tin sulfides, an antimony trioxide, diacid-ized germanium, etc. can use the esterification catalyst or ester interchange catalyst used by a usual esterification reaction or a usual ester exchange reaction. Moreover, what is necessary is to be limited neither about polymerization temperature nor especially the amount of catalysts, and just to set it as arbitration if needed.

[0026] As for the content of the alicyclic frame contained in this polyester system resin, it is desirable that it is 0.1 - 10 % of the weight to this toner AUW. The fact of being the same as that of the above-mentioned is cited as this reason. If it is less than 0.1 % of the weight, the environmental stability of the electrification nature of this toner will be spoiled, and if it exceeds 10 % of the weight, possibility that nonconformity, like fogging on the outputted image increases will occur will increase. The more desirable range is 0.5 - 5 % of the weight.

[0027] Moreover, the alicyclic frame may be contained in any of a carboxylic-acid component or an alcoholic component, and may be further contained to both. As a concrete example of an alicyclic frame, cycloalkyl radicals, such as cyclohexyl and cyclodecyl, a cyclo alkenyl radical, etc. were mentioned suitably, and as long as it is the substituent which does not check the electrophotographic properties of this toner, you may combine with these rings.

[0028] It is desirable, if it does not have an adverse effect on the property of others of a toner in order that the sites to which the moisture contained in a toner sticks may decrease in number and environmental stability may improve in this polyester system resin, in not containing an oxyethylene chain and/or an oxypropylene chain.

[0029] Since an electrification property improves and imprint nature becomes good by not containing a ring, the polyester system resin of this invention is desirable.

[0030] As for the acid number of said polyester system resin, it is desirable that they are 0.01 - 20mgKOH / 1g of resin. Since it will become easy to leak the charge of a toner under a high-humidity condition if it becomes easy to carry out the charge up under damp conditions and 20 is exceeded on the other hand when it considers as a toner for it to be less than 0.01, it is not desirable.

[0031] mg of a potassium hydroxide required in order that the acid number may neutralize the acid contained in 1g of samples -- it is a number (JIS K676) and titrating, for example, using indicators, such as a phenolphthalein, as the measuring method, measuring with potentiometric titration, etc. are mentioned. Furthermore, when a value is small, the heavy-metal salt amount contained after making heavy-metal salts, such as a silver nitrate, react to a resin solution and washing an excessive salt may be calculated by the approach of carrying out a quantum according to a fluorescence-X-rays spectrum, an atomic absorption spectrum, etc.

[0032] The structure of this polyester system resin does not need to be linear resin, is carrying out copolymerization of the monomer of three or more organic functions, and can also be used as polyester system resin which has branching.

[0033] Although the approach of controlling by the ratio of all the above-mentioned acid components

and all alcoholic components is common as an approach of adjusting the molecular weight of polyester system resin, it is not restricted to especially it.

[0034] Furthermore, the activity of the graft denaturation copolymer which carried out the graft of a block copolymer with the above-mentioned polyester system resin, a polystyrene and styrene-(meta) acrylic copolymer, common polyester, polyurethane and an epoxy resin, polyolefine, a polyamide, polysulfone, the polish anoa reel ether, the poly arylene sulfide, etc., alkyl (meta) acrylate, an acrylic acid (meta), a maleic acid, a styrene system monomer, etc. as polyester system resin in this invention is also possible.

[0035] As for the molecular weight of this polyester system resin, in the molecular weight distribution by the gel permeation chromatography (GPC) mentioned later, it is desirable that peak molecular weight is within the limits of 1000-500000. If the blocking resistance of a toner gets worse at the time less than of 1000, or possibility of having an adverse effect on electrification nature becomes very high and 500000 is exceeded, the melt viscosity of a toner may become high and may produce a problem in fixable. Moreover, peak molecular weight is mentioned as range where 2000-100000 are more desirable.

[0036] 0.1-50 weight section content of this polyester system resin must be carried out to this toner AUW, and it is desirable that it is 0.1 - 30 % of the weight also in it. If it is less than 0.1 % of the weight, the environmental stability of the electrification nature of this toner will be spoiled, and if it exceeds 50 % of the weight, possibility that nonconformity, like fogging on the outputted image increases will occur will increase. As more desirable range, 0.2 - 20 % of the weight can be mentioned.

[0037] As other resin used together with the above-mentioned polyester resin in this invention, various resin, such as styrene-acrylic resin generally used, polyester system resin, and epoxy system resin, is mentioned, and especially styrene-acrylic resin can be obtained by carrying out the polymerization of the monomer for forming them. Specifically The styrene monomer like styrene, o(m-, p-)methyl styrene, and m(p-)ethyl styrene, A methyl acrylate, an ethyl acrylate (meta), acrylic-acid (meta) propyl, (Meta) Butyl acrylate, acrylic-acid (meta) octyl, acrylic-acid (meta) dodecyl, (Meta) Acrylic-acid stearyl, acrylic-acid (meta) behenyl, 2-ethylhexyl acrylate (meta), (Meta) (Meta) The acrylic ester system monomer like acrylic-acid dimethylaminoethyl and an acrylic-acid (meta) diethylaminoethyl (meta), a butadiene, an isoprene, a cyclohexene, acrylonitrile (meta), and the en system monomer like acrylamide are used preferably. Independently [ these ] or generally, a monomer is mixed suitably and the theoretical glass transition temperature (Tg) of a publication is used for 2nd edition III-pl 39-192 (product made from John Wiley&Sons) of a publication polymer handbook so that 40-75 degrees C may be shown. When theoretical glass transition temperature is less than 40 degrees C, it is easy to produce a problem from Men of the preservation stability of a toner, or durable stability, and in exceeding 75 degrees C on the other hand, it brings about lifting of the established point of a toner. In the case of the color toner for forming especially a full color image, the color mixture nature at the time of fixation of each color toner falls, and it is lacking in color repeatability, and since the transparency of an OHP image falls further, it is not desirable.

[0038] The measuring method of "the molecular weight distribution by GPC" in this invention is as follows.

[0039] (Measurement of the molecular weight distribution by GPC) In this invention, the molecular weight of the resin in a toner was calculated as polystyrene conversion molecular weight from the molecular weight distribution in gel permeation chromatography (GPC).

[0040] First, as preparation of a sample, a toner is made to dissolve in a tetrahydrofuran (THF) at a room temperature, and the diameter of pore filters the obtained solution with the membrane filter made from a solvent-proof which is 0.2 micrometers so that the resinous principle in a sample may become in ml and 0.4-0.6mg /.

[0041] Next, a column is stabilized in a 40-degree C heat chamber, as a solvent, by the rate of flow 1ml/m, about 100microl impregnation of a sink and the THF sample solution is carried out, and a tetrahydro furan (THF) is measured. In the molecular weight measurement of a sample, the molecular weight distribution which a sample has was computed from the relation of the pair numeric value of a



calibration curve and the number of counts which were created by several sorts of mono dispersion polystyrene standard samples. The standard polystyrene sample for calibration-curve creation is TSK by TOSOH CORP. Standard Polystyrene The calibration curve was created using F-850, F450, F-288, F-128, F-80, F-40, F-20, F10, F-4, F-2, F-1, A-5000, A-2500, A-1000, and A-500. Moreover, the detector arranged and used RI (refractive index) detector and UV (ultraviolet rays) detector for the serial. In addition, as a column, it is good to combine two or more commercial polystyrene gel columns, and it is shodexGPC by Showa Denko K.K. at this invention. It measured in the combination of KF-801, and 802, 803, 804 and 805,806,807,800P. Equipment is high speed gel permeation chromatography. HLC8120 GPC (TOSOH CORP. make) was used.

[0042] In this invention, it is desirable that the content of a with a GPC molecular weight of 1000 or less which has the repeat unit of polyester system resin in structure compound is 10.0 or less % of the weight to a toner. Although the compound which has an adverse effect on various engine performance and properties of a toner was applied to the monomer of polyester system resin etc., when these contents have the content and proportionality of a with a GPC molecular weight [ said ] of 1000 or less compound and carried out the content of a with a GPC molecular weight [ said ] of 1000 or less compound to 10.0 or less % of the weight to the toner, it became clear by various examination of this invention persons that many aforementioned problems were not produced. Moreover, in order to raise the engine performance and the property of a toner further, it is more desirable to \*\*\*\* the content of a with a GPC molecular weight [ said ] of 1000 or less compound to 5.0 or less % of the weight. Of course, it cannot so be overemphasized that a with a GPC molecular weight of 1000 or less which it has in structure compound is not detected [ unit / of polyester system resin / repeat ] at all as a line in various analysis of a toner that it is desirable to use the small polyester system resin of a variance ratio.

[0043] In this invention, the quality of a with a GPC molecular weight of 1000 or less compound and quantitative analysis which have the repeat unit of polyester system resin in structure can be carried out by various approaches. For example, what is necessary is just to analyze a toner by various approaches, such as a chemical analysis of analyses of a spectrum, such as a nuclear-magnetic-resonance spectrum (1 H-NMR, 13 C-NMR), an infrared absorption spectrum (IR), a Raman spectrum, an ultraviolet absorption spectrum (UV), and a mass spectrum (MS), elemental analysis, GPC, a gas chromatography (GC), liquid chromatography (HPLC), and others. Moreover, what is necessary is to carry out the Soxhlet extraction of the toner with the solvent which dissolves binding resin, such as a tetrahydrofuran and toluene, and for an evaporator just to perform the aforementioned analysis for filtrate after concentration with the toner itself, when analysis is difficult. Furthermore, adoption of various analysis means, such as performing the above-mentioned analysis about the sample which isolated the with a molecular weight of 1000 or less component preparatively by liquid chromatography or GPC, and the sample which it is independent or was extracted with the mixed solvent, is possible. Moreover, these analysis means are independent and combining and using if needed is possible.

[0044] In order to improve imprint nature and development nature with sufficient balance, the following configurations of the configuration of the toner of this invention are indispensable. whenever [ namely, / mean circle form / in / the circle equivalent number pitch diameter in the particle-size frequency distribution of the number criteria of a toner is 2-10 micrometers and / circularity frequency distribution ] -- 0.950-0.995 -- preferably, it is 0.975-0.995 still more preferably, and circularity standard deviation can improve imprint nature and development nature with sufficient balance less than 0.040 0.970-0.995, and by controlling the particle shape of a toner to a precision to become less than 0.035 preferably.

[0045] By diameter[ of a granule ]-izing the circle equivalent number pitch diameter in the particle-size frequency distribution of the number criteria of a toner with 2-10 micrometers, the profile part of an image, especially the repeatability in an alphabetic character image or the development of a line pattern will become good. However, if a toner particle was generally diameter[ of a granule ]-ized, since the abundance of the toner of minute particle size would become high inevitably, it became difficult to electrify a toner in homogeneity, and the adhesion force to about [ producing image fogging ] and an electrostatic latent-image support front face became high, and had caused the increment in a transfer



residual toner as a result.

[0046] However, the toner of this invention becomes the stability over the environmental variation of development nature or imprint nature, and what has good endurance further by controlling the circularity standard deviation of circularity frequency distribution as mentioned above. I think that it is because they can maintain sufficient amount of toner coats even if they make restraining force of toner layer specification-part material stronger than usual in case this invention persons form the thin layer of a toner on toner support in a development process, so it becomes possible as the reason to make the amount of toner electrifications on toner support higher than usual, without giving the damage to toner support.

[0047] moreover, by controlling whenever [ mean circle form / of circularity frequency distribution ] as mentioned above, by the former, while the imprint nature of the toner which presents the difficult diameter of a granule makes it improve substantially, the development capacity over a low voltage latent image is also boiled markedly, and improves. It is effective when developing the minute spot latent image of a digital method especially.

[0048] When whenever [ mean circle form ] is less than 0.920, about [ that the product made from an imprint gets worse ] and development nature may fall. Moreover, if whenever [ mean circle form ] exceeds 0.995, degradation of a toner front face will become remarkable and will come to produce a problem in endurance etc.

[0049] It used as a simple approach of expressing the configuration of a toner particle as the projected area diameter of the toner in this invention, circularity, and those frequency distribution quantitatively, and in this invention, it measured using flow type particle image measuring device FPIA-1000 mold (TOA Medical Electronics Co., Ltd. make), and computed using the bottom type.

[0050]

[Equation 1]

円相当径 = (粒子投影面積 /  $\pi$ )<sup>1/2</sup> × 2

円形度 =  $\frac{\text{粒子投影面積と同じ面積の円の周囲長}}{\text{粒子投影像の周囲長}}$

[0051] Here, "particle projected area" is the area of the toner particle image by which binarization was carried out, and it is defined as the die length of the border line which connects the edge point of this toner particle image to "the boundary length of a particle projection image", and is obtained.

[0052] The circularity in this invention is an index which shows the degree of the irregularity of a toner particle, and circularity serves as a small value, so that 1.00 is shown and the shape of surface type becomes complicated, when a toner particle is a perfect globular form.

本発明において、トナーの個数基準の粒径頻度分布の平均値を意味する円相当

個数平均粒子径  $\overline{D1}$  と粒径標準偏差  $SDd$  は、粒度分布の分割点  $i$  での粒径 (中心値) を  $\overline{di}$ 、頻度を  $f_i$  とすると次式から算出される。

[0053]

[Equation 2]

円相当個数平均粒子径  $\overline{di} = \frac{\sum_{i=1}^n (f_i \times di)}{\sum_{i=1}^n (f_i)}$

粒径標準偏差  $SDd = \left\{ \frac{\sum_{i=1}^n (D1 - di)^2}{\sum_{i=1}^{n-1} (f_i)} \right\}^{1/2}$

[0054]

また、円形度頻度分布の平均値を意味する平均円形度 $\bar{c}$ と円形度標準偏差SD

$c$ は、粒度分布の分割点 $i$ での円形度(中心値)を $c_i$ 、頻度を $f_{ci}$ とすると、次式から算出される。

[0055]

[Equation 3]

$$\text{平均円形度 } \bar{c} = \frac{\sum_{i=1}^m (c_i \times f_{ci})}{\sum_{i=1}^m (f_{ci})}$$

$$\text{円形度標準偏差 } SD_c = \left\{ \frac{\sum_{i=1}^m (\bar{c} - c_i)^2}{\sum_{i=1}^m (f_{ci})} \right\}^{1/2}$$

[0056] As a concrete measuring method, 10ml of ion exchange water from which the impure solid etc. was removed beforehand is prepared into a container, a surface active agent and after adding alkylbenzene sulfonates preferably, 0.02g is added and homogeneity is made to distribute a test portion further as a dispersant in it. As a means to distribute, it considers as the dispersion liquid for measurement using distributed processing using what equipped ultrasonic disperser UH-50 mold (product made from S EMUTE) with the titanium-alloy chip of 5phi as a trembler for 5 minutes. It cools suitably to the appearance from which the temperature of these dispersion liquid does not become 40 degrees C or more in that case.

[0057] Using said flow type particle image measuring device, this dispersion-liquid concentration is readjusted to configuration measurement of a toner particle so that the toner particle concentration at the time of measurement may be set to 3000-10,000 piece [/micro] l, and 1000 or more toner particles are measured. A projected area diameter, circularity frequency distribution, etc. of a toner are searched for after measurement using this data.

[0058] In this invention, in order to make it correspond to various imprint material, a medium imprint object can be established. In that case, since an imprint process is performed two parenchyma, the decline in imprint effectiveness causes decline in the utilization effectiveness of a toner remarkably, and poses a problem. In a digital full colour copying machine or a printer Beforehand a color image manuscript B (blue) filter, G (Green) filter, After separating the color using R (red) filter, a 20-70-micrometer dot latent image is formed on a photo conductor. It is necessary to use a primary color mixing operation using each color toner of Y (yellow) toner, M (Magenta) toner, C (cyanogen) toner, and B (black) toner, and to reproduce a multicolor color picture faithful to a manuscript. On a photo conductor or a medium imprint object, under the present circumstances, Y toner, M toner, C toner, Each color toner with which B toner is used for this invention in order that a toner may ride so much corresponding to the color information on a manuscript or CRT In order to require very high imprint nature and to realize it, as for 0.920-0.995, and the toner particle whose circularity standard deviation it is 0.970-0.995 preferably and is less than 0.035 preferably less than 0.040, whenever [ mean circle form / which was mentioned above ] is desirable.

[0059] It is desirable to blend the waxes used into the toner as release agents, such as a hydrocarbon system compound, a higher fatty acid, higher alcohol, and those derivatives, in order to raise the mold-release characteristic at the time of hot calender roll fixation in this invention. As such waxes, paraffin wax and its derivative, a micro crystallin wax and its derivative, the Fischer Tropsch wax and its derivative, a polyolefine wax and its derivative, carnauba wax and its derivative, alcohol, a fatty acid, an acid amide, ester, a ketone, hydrogenated castor oil and its derivative, a vegetable system wax, an animal system wax, a mineral system wax, a PETORO lactam, etc. are mentioned, and, specifically, oxide, a block copolymerization object with a vinyl system monomer, and a graft denaturation object are contained in a derivative. These release agents are independent, or even if they use two or more sorts together, they do not interfere at all.

[0060] These wax components have the maximum endoergic peak to a 40-130-degree C field in the DSC curve measured with a differential-scanning-calorie meter at the time of temperature up. A mold-release characteristic is also discovered effectively, contributing to low-temperature fixation greatly by having the maximum endoergic peak to the above-mentioned temperature field. While the autoagglutination force of a wax component becomes it weak that this maximum endoergic peak is less than 40 degrees C and elevated-temperature-proof offset nature gets worse as a result, a gross becomes high too much. Since it becomes difficult to make a fixation image front face graduate moderately on the other hand while fixation temperature will become high, if this maximum endoergic peak exceeds 130 degrees C, when it uses especially for a color toner, it is not desirable from the point of color mixture nature lowering. Furthermore, when performing granulation/polymerization in a drainage system medium and obtaining a direct toner with a polymerization method, it produces the problem of a wax component mainly depositing during granulation and is not desirable if this maximum endoergic peak temperature is high.

[0061] Measurement of the maximum endoergic peak temperature of a wax component is performed according to "ASTM D 3418-8." measurement -- for example, the PerkinElmer, Inc. make -- DSC-7 are used. The temperature compensation of an equipment detecting element uses the heat of fusion of an indium about amendment of a heating value using the melting point of an indium and zinc. An empty pan is set to a measurement sample for contrast using the pan made from aluminum, and it measures by the programming rate of 10 degrees C / min.

[0062] In this invention, although especially the addition of these wax components is not limited, 0.5 - 30% of the weight of its range is desirable to a toner.

[0063] Inorganic and organic the color and pigment of the coloring agent used for this invention known conventionally are usable, the yellow coloring agent, Magenta coloring agent, and cyanogen coloring agent which are shown below are mentioned, and that by which mixed the yellow coloring agent / Magenta coloring agent / cyanogen coloring agent shown in carbon black aniline black, acetylene black, the magnetic substance, a baking pigment, or the following as a black coloring agent, and black toning was carried out is used.

[0064] Furthermore, a magnetic material is used for the toner of this invention as a black coloring agent, and can be used for it also as a magnetic toner. Under the present circumstances, the alloy of a metal like the aluminum of ferrous oxide, such as magnetite, hematite, and a ferrite, iron, cobalt, metals like nickel, or these metals, cobalt, copper, lead, magnesium, tin, zinc, antimony, beryllium, a bismuth, KADONIUMU, calcium, manganese, a selenium, titanium, a tungsten, and vanadium as a magnetic material which can be used, and its mixture are mentioned.

[0065] It is more desirable that it is the magnetic substance by which surface treatment was carried out, and when using for a polymerization method toner, as for the magnetic substance used for this invention, what performed hydrophobing processing by the surface treatment agent which is the matter without polymerization inhibition is desirable. As such a surface treatment agent, a silane coupling agent, a titanium coupling agent, etc. can be illustrated, for example.

[0066] 2 micrometers or less of mean particle diameter of these magnetic substance are an about 0.1-0.5-micrometer thing preferably. as the amount of the magnetic substance made to contain in a toner particle -- the resin 100 weight section -- receiving -- the 20 - 200 weight section -- it is the 40 - 150 weight section especially preferably. Moreover, the magnetic substance of coercive force (Hc)20-300 oersted, saturation magnetization (sigmas) 50 - 200 emu/g, and residual magnetization (sigmar) 2 - 20 emu/g has the desirable magnetic properties in 10k oersted impression.

[0067] As a yellow coloring agent, the compound represented by a condensation azo compound, an isoindolinone compound, the Anthraquinone compound, an azo metal complex, a methine compound, and the allyl compound amide compound is used. Specifically, the C.I. pigment yellow 12, 13, 14, 15, 17, 62, 74, 83, 93, 94, 95, 109, 110, 111, 128, 129, 147, and 168 and 180 grades are used suitably.

[0068] As a Magenta coloring agent, a condensation azo compound, a diketo pyrrole pyrrole compound, Anthraquinone, the Quinacridone compound, a base color lake compound, a naphthol compound, a bends imidazolone compound, a thioindigo compound, a perylene compound, etc. are used. The C.I.

pigment red 2, 3, 5, 6, 7, 23, 48:2, 48:3, 48:4, 57:1, 81:1, 144, 146, 166, 169, 177, 184, 185, 202, 206, 220, 221, and 254 is especially specifically desirable.

[0069] As a cyanogen coloring agent, a copper-phthalocyanine compound and its derivative, the Anthraquinone compound, a base color lake compound, etc. can be used. Specifically, the C.I. pigment blues 1, 7, 15, 15:1, 15:2, 15:3, 15:4, 60, and 62 and 66 grades can use suitably especially.

[0070] these coloring agents are independent -- or it can mix and can use in the state of the solid solution further. A coloring agent is chosen from the point of a hue, saturation, lightness, weatherability, OHP transparency, and dispersibility. As for the addition of this coloring agent, it is desirable to carry out a 1-20 weight section activity to the resinous principle 100 weight section.

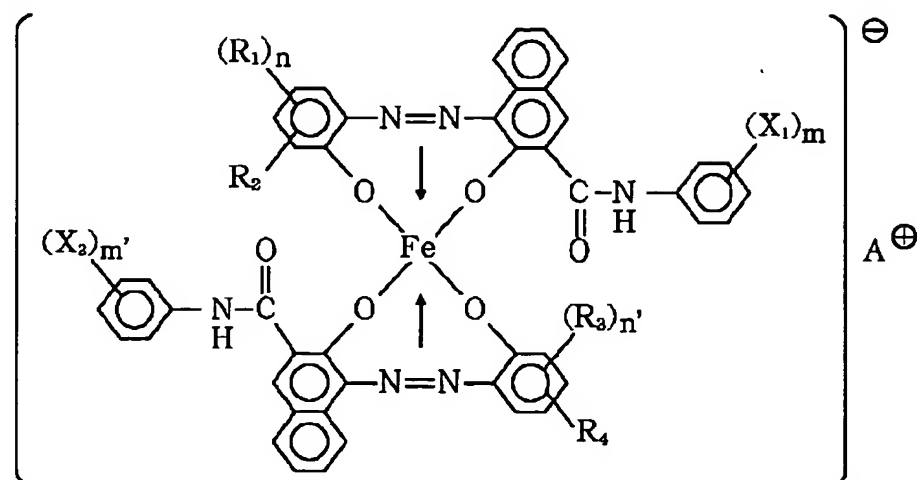
[0071] The electrification control agent to which a well-known thing can be used for as an electrification control agent used for the toner of this invention, and especially electrification speed is stabilized and can maintain the fixed amount of electrifications quickly is desirable. Furthermore, when manufacturing a toner particle using a direct polymerization method, polymerization inhibition nature is low and especially the electrification control agent that does not have substantially a meltable ghost to a drainage system dispersion-medium object is desirable. As a concrete compound, the macromolecule mold compound which has the metal salt of the metallic compounds of the aromatic carboxylic acid like a salicylic acid, a naphthoic acid, and a die carboxylic acid, azo dye, or an azo pigment or a metal complex, a sulfonic acid, or a carboxylic-acid radical in a side chain as a negative system electrification control agent, a boron compound, a urea compound, a silicon compound, carixarene, etc. are mentioned. The giant-molecule mold compound which has quarternary ammonium salt and this quarternary ammonium salt in a side chain as a positive system electrification control agent, a guanidine compound, an imidazole compound, etc. are mentioned. As for this electrification control agent, it is desirable to carry out a 0.5-10 weight section activity to the resin 100 weight section. However, an electrification control agent does not necessarily need to be included in a toner particle by addition of an electrification control agent not being indispensable in this invention, using frictional electrification with a carrier, when the 2 component development approach is used, and using positively frictional electrification with a blade member or a sleeve member, when the nonmagnetic 1 component blade coating development approach is used.

[0072] In this invention, the compound shown in the following general formula (I) among the above-mentioned electrification control agents is more desirable.

[0073]

[Formula 4]

## 一般式 (I)



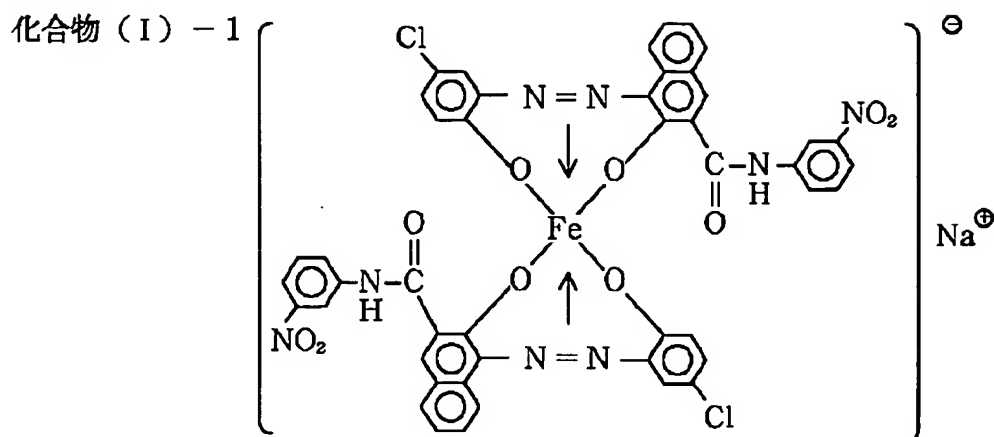
[式中、 $X_1$ および $X_2$ は水素原子、低級アルキル基、低級アルコキシ基、ニトロ基及びハロゲン原子からなるグループから選択されるメンバーを表示し、 $X_1$ と $X_2$ は同じ又は異なっており、 $m$ および $m'$ は1～3の整数を表示し、 $R_1$ および $R_3$ は水素原子、 $C_1 \sim C_{18}$ のアルキル基、 $C_2 \sim C_{18}$ のアルケニル基、スルホンアミド基、メシル基、スルホン酸基、ヒドロキシ基、 $C_1 \sim C_{18}$ のアルコキシ基、アセチルアミノ基、ベンゾイルアミノ基及びハロゲン原子又は $-\overset{\overset{\text{O}}{\parallel}}{\text{C}}-\text{O}-R_6$ からなるグループから選択されるメンバーを表示し、 $R_1$

と $R_3$ は同じ又は異なっており、 $n$ および $n'$ は1～3の整数を表示し、 $R_2$ および $R_4$ は水素原子またはニトロ基を表示し、 $R_6$ はアルキル基又はアリール基を表示し、 $A^+$ はアンモニウムイオン、水素イオン、ナトリウムイオン及びカリウムイオンからなるグループから選択されるカチオンイオンを示す。]

[0074] The following compounds are mentioned as a typical example of said electrification control agent.

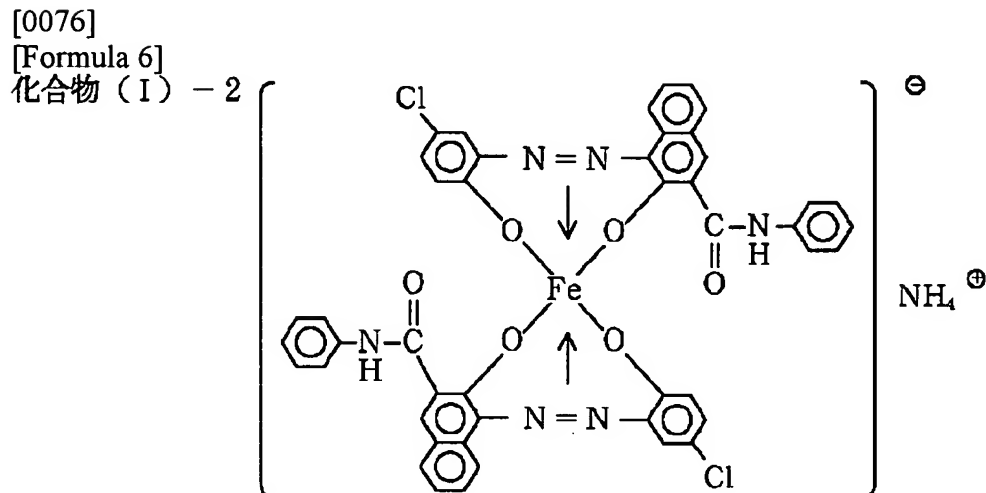
[0075]

[Formula 5]



[0076]

[Formula 6]



[0077] Although various approaches as the manufacture approach of the toner by this invention are mentioned For example, the binding resin which consists of polyester system resin and other resin in manufacturing by the grinding method, A wax component, a coloring agent and/or the magnetic substance, an electrification control agent, or other additives A Henschel mixer, Mix enough with the mixer like a ball mill, carry out melting kneading using the heat kneading machine like a pressurized kneader or an extruder, a solid is made to collide with a target by mechanical or jet mind flowing down after cooling solidification, and it pulverizing-izes to a desired toner particle size. Then, smoothing and conglobation processing of a toner particle are performed if needed. Subsequently, particle size distribution are made into Sharp through a classification process. Furthermore, the toner of this invention can be obtained by mixing a toner particle with plasticizers, such as a particle silica, enough with the mixer like a Henschel mixer. Moreover, as the manufacture approach of other toners, a plasticizer or the polyester system resin superfines-sized independently is added to a toner particle, it mixes enough, there is also a method of making a toner particle front face fix polyester system resin, polyester system resin may be contained in the binding resin in a toner particle in this case, and it does not need to be contained at all. Moreover, after making it fix, smoothing and conglobation processing of a toner particle may be performed.

[0078] furthermore, in manufacturing the toner of this invention by the polymerization method Polyester system resin is dissolved in a monomer constituent. JP,36-10231,B, How to manufacture a direct toner using the suspension-polymerization approach which is stated to JP,59-53856,A and JP,59-61842,A, The toner of this invention can be obtained by the emulsion-polymerization approach represented by the soap free polymerization method for the meltable and obtained polymer carrying out direct polymerization to a monomer under the distributed polymerization method which manufactures a direct toner using an insoluble drainage system organic solvent, or water-soluble polymerization initiator

existence, and manufacturing a toner. Moreover, manufacture the polymer particle which does not contain polyester system resin by the polymerization method, particle-like polyester system resin is made to adhere to the front face of a polymer particle after that, and the approach of performing smoothing and conglomeration processing of a particle if needed, and the approach of carrying out the seed polymerization of the monomer (constituent) containing polyester system resin can also be adopted. Moreover, the method of atomizing in air the melting mixture which contains polyester system resin as the other approaches using the disk or many hydraulic nozzles of a publication in JP,56-13945,B etc., and obtaining a globular form toner etc. is illustrated.

[0079] The particle size distribution of the toner with which the melting spray method was acquired tend to become large among the manufacture approaches of the above mentioned toner. On the other hand, although the toner with which a distributed polymerization method is acquired shows very sharp particle size distribution, from a viewpoint concerning [ selection of the ingredient to be used being narrow or utilization of an organic solvent ] processing of a waste solvent, and the inflammability of a solvent, its manufacturing installation is complicated and tends to make it complicated. Moreover, although there is an advantage that the particle size distribution of a toner gather comparatively, as for the emulsion-polymerization approach, the grain size of the particle generally generated is dramatically fine, and it is difficult to use it as it is as a toner. Furthermore, the end and emulsifier of a water-soluble polymerization initiator which were used exist in a toner particle front face, and environmental capability may be worsened.

[0080] On the other hand, the manufacture approach by smoothing and conglomeration processing of a toner particle and the manufacture approach by the polymerization method are easy to store in the range which wishes the circularity and circularity standard deviation of a toner, and can be called desirable manufacture approach. Moreover, configuration control of a toner particle is easy for especially the method of manufacturing the toner of this invention by the polymerization method, and since it can be used if polyester system resin is dissolved into a monomer constituent, the class of resin which can be used is the many especially desirable manufacture approach.

[0081] Even if it may contain in the toner the polyester system resin contained in the toner of this invention in the state of what kind of configuration and it is in other binding resin and the dissolved condition, it may be in the condition which carried out phase separation. For example, when carrying out melting kneading of polyester system resin, other binding resin, etc. by the above mentioned grinding method, you may be in the condition distributed in other binding resin with which melting of the polyester system resin does not have to be carried out, and melting was not necessarily carried out at this melting kneading process. In such a case, the polyester system resin in a toner will be in the condition of having distributed in other binding resin used together. When dissolution mixing of polyester system resin and other binding resin is beforehand carried out at homogeneity using solvents, such as a xylene Although it is satisfactory since polyester system resin is compatibility-ized by micro-disperse or the case in other resin In kneading the powder of polyester system resin, and other binding resin, without carrying out such equalization actuation and kneading under with the melting temperature of this polyester system resin Since polyester system resin powder will be distributed in a toner, it is good to use 1 micrometer or less of polyester system resin preferably pulverized to 0.5 micrometers or less.

[0082] when use a polymerization method as the manufacture approach of a toner , particle size distribution control of a toner particle and control of particle size can obtain a predetermined toner particle by control the approach of change the class and addition of the dispersant which carry out the mineral salt of difficulty water solubility , and a protective colloid operation , mechanical contrivance conditions ( for example , churning conditions , such as peripheral speed of a rotor , a count of pass , and an impeller configuration , and a container configuration ) or the solid content concentration in the inside of a water solution , etc.

[0083] In case a toner is manufactured by the direct polymerization method, as a polymerization initiator used for example - azobis (2,4-dimethylvaleronitrile), and 2 and 2 '2, 2'-azobisisobutyronitril, - azobis (cyclohexane-1-carbonitrile), and 1 and 1 '2, 2'-azobis-4-methoxy-2,4-dimethylvaleronitrile, The azo system or diazo series polymerization initiator like azobisisobutyronitril; Benzoyl peroxide, The



peroxide system polymerization initiator like methyl ethyl ketone peroxide, diisopropyl peroxy carbonate, cumene hydronalium peroxide, 2,4-dichlorobenzyl peroxide, and lauroyl peroxide is used. Although the amount of this polymerization initiator used changes with target polymerization degree, generally 0.5 - 20 % of the weight is used to a polymerization nature monomer. although the class of polymerization initiator changes a little with polymerization methods, it is independent to reference in 10-hour half-life temperature -- or it is mixed and used. Moreover, in order to control polymerization degree, it may add further and a well-known cross linking agent, a chain transfer agent, polymerization inhibitor, etc. may be used.

[0084] When using the suspension-polymerization method using the distributed stabilizer as a manufacturing method of a toner, as a distributed stabilizer to be used, tricalcium phosphate, magnesium phosphate, aluminium phosphate, phosphoric-acid zinc, a calcium carbonate, a magnesium carbonate, a calcium hydroxide, a magnesium hydroxide, an aluminum hydroxide, a meta-calcium silicate, a calcium sulfate, a barium sulfate, a bentonite, a silica, an alumina, etc. are mentioned as an inorganic compound. As an organic compound, polyvinyl alcohol, gelatin, hydroxyethyl cellulose, methyl cellulose, methyl hydroxypropylcellulose, ethyl cellulose, a carboxymethyl cellulose and its sodium salt, polyacrylic acid and its salt, starch, etc. are mentioned. As for these distributed stabilizers, it is desirable to use 0.2 - 20 weight section to the polymerization nature monomer 100 weight section.

[0085] As a distributed stabilizer, when using an inorganic compound, a commercial thing may be used as it is, but in order to obtain a fine particle, the particle of this inorganic compound may be generated in a distributed medium. For example, in the case of tricalcium phosphate, it is good to mix an sodium phosphate water solution and a calcium chloride water solution under high-speed churning.

[0086] For detailed distribution of these distribution stabilizer, the surfactant of the 0.001 - 0.1 weight section may be used together. This is for promoting an operation of the above-mentioned distributed stabilizer, for example, a dodecylbenzene sodium sulfate, the sodium tetradecyl sulfate, a pentadecyl sodium sulfate, an octyl sodium sulfate, sodium oleate, lauryl acid sodium, a stearin acid potassium, oleic acid calcium, etc. are mentioned.

[0087] When using a direct polymerization method as the manufacture approach of the toner of this invention, the manufacture approach like a less or equal is possible.

[0088] Into a polymerization nature monomer, the additive of a wax component, a coloring agent, an electrification control agent, a polymerization initiator, and others is added, and the monomer constituent dissolved or distributed to homogeneity by the homogenizer, the ultrasonic disperser, etc. is distributed with the usual agitator or a homomixer, a homogenizer, etc. in the aqueous phase containing a distributed stabilizer. An agitating speed and churning time amount are adjusted and corned so that the drop of a monomer constituent may have the size of a desired toner particle preferably. What is necessary is just to perform after that churning which is extent with which a particle condition is maintained and sedimentation of a particle is prevented according to an operation of a distributed stabilizer. Polymerization temperature is good to set it as the temperature of 50-90 degrees C, and to perform 40 degrees C or more of polymerizations generally. Temperature up may be carried out in the second half of a polymerization reaction, and a drainage system medium may be further distilled out of the system of reaction in part for the object of improvement in endurance by the image formation approach in this invention after the reaction second half for removing an unreacted polymerization nature monomer, a by-product, etc., or reaction termination. Washing and filtration recover the generated toner particle after reaction termination, and it dries. In a suspension-polymerization method, it is desirable to usually use water 300 - the 3000 weight sections as a dispersion-medium object to the monomer constituent 100 weight section.

[0089] Moreover, since it will not become the invert ratio of a request of a polymerization nature monomer if it is less than 2 hours, but reaction time will be too long and productivity will become low if it will become there is much unreacted polymerization nature monomer and complicated [ the clearance process ] and exceeds 24 hours, 2 - 24 hours of reaction time are desirable.

[0090] About particle size distribution, you may measure with the aforementioned flow type particle image measuring device, and may carry out using the multi-sizer of a Coulter counter.



[0091] That is, the latter connects the interface (product made from the department machine of a day) and personal computer which output number distribution and volume distribution, using a Coulter counter TA-II mold (coal tar company make) as a measuring device, and the electrolytic solution prepares a NaCl water solution about 1% using the 1st class sodium chloride. For example, ISOTON II (made in coal tar scientific Japan) can be used. As a measuring method, 0.1-5ml (preferably alkylbenzene sulfonate) of surface active agents is added as a dispersant into 100-150ml of said electrolysis water solutions, and 2-20mg of test portions is added further. The electrolytic solution which suspended the sample performed distributed processing for about 1 - 3 minutes with the ultrasonic distribution vessel, and it computed volume distribution and number distribution by having measured the volume of a toner, and the number with said Coulter counter TA-II mold, using for example, 100-micrometer aperture as an aperture. And it asks for the weight mean diameter of the weight criteria concerning this invention from volume distribution.

[0092] Although it is indispensable that the polyester system resin which has alicyclic structure contains as some binding resin at least as for the toner of this invention, the quality of this polyester system resin and quantitative analysis can be carried out by various approaches. For example, what is necessary is just to analyze a toner by various approaches, such as a chemical analysis of analyses of a spectrum, such as a nuclear-magnetic-resonance spectrum (1 H-NMR, 13 C-NMR), an infrared absorption spectrum (IR), a Raman spectrum, an ultraviolet absorption spectrum (UV), and a mass spectrum (MS), elemental analysis, GPC, a gas chromatography (GC), liquid chromatography (HPLC), and others. Moreover, what is necessary is to carry out the Soxhlet extraction of the toner with the solvent which dissolves binding resin, such as a tetrahydrofuran and toluene, and for an evaporator just to perform the aforementioned analysis for filtrate after concentration with the toner itself, when analysis is difficult. Furthermore, adoption of various analysis means, such as performing the above-mentioned analysis about the sample which isolated preparatively the with a GPC molecular weight of 1000 or more component by liquid chromatography or GPC, or the sample which it is independent or was extracted with the mixed solvent, is possible. These analysis means are independent and combining and using if needed is possible.

[0093] In the toner of this invention, it is desirable to consider as an additive, to mix with a toner particle and to use non-subtlety fine particles because of electrification stability, development nature, a fluidity, and the improvement in endurance.

[0094] As non-subtlety fine particles used for this invention, silica pulverized coal, titanium oxide, alumina pulverized coal, etc. are mentioned. A result with a specific surface area good [ the thing within the limits more than 30m<sup>2</sup>/g (especially 50-400m<sup>2</sup>/g) ] by the nitrogen adsorption measured with the BET adsorption method also in this is given. It is good the non-subtlety fine particles 0.01 - 8 weight sections, and to carry out a 0.1-5 weight section activity preferably to the toner 100 weight section.

[0095] According to the BET adsorption method, specific surface area made nitrogen gas stick to a sample front face using specific-surface-area measuring device auto SOBU 1 (Yuasa Ionics make), and computed specific surface area using the BET multipoint method.

[0096] As for the non-subtlety fine particles used for this invention, it is also desirable to be processed by the silane coupling agent and the processing agent like other organic silicon compounds which have a silicone varnish, various denaturation silicone varnishes, silicone oil, various denaturation silicone oil, a silane coupling agent, and a functional group for the object of hydrophobing and electrification nature control if needed.

[0097] As other additives, the development disposition top agent like the abrasive material (strontium titanate is desirable especially); caking inhibitor; carbon black, the zinc oxide, the antimony oxide, the electro-conductivity applying agent; toner particle like the tin oxide, the white particle of reversed polarity, and black particle like lubricant (polyvinylidene fluoride is desirable especially); cerium oxide, silicon carbide, and strontium titanate like Teflon, zinc stearate, and polyvinylidene fluoride is mentioned.

[0098] It can set to this invention and, in the case of the toner which agitated a non-subtlety particle and other additives to the toner particle, was mixed, and was manufactured, measurement of the various

physical-properties values which a toner particle has can be performed using the toner particle after removing these non-subtlety particle and other additives. Especially the method of removing these non-subtlety particle and other additives can be performed by rinsing a toner as follows, for example, although not restricted.

[0099] A toner is added into the water which added surfactants, such as sodium dodecylbenzenesulfonate, first, and it fully agitates and mixes. By this actuation, a non-subtlety particle and other additives with a comparatively big particle size are isolated from a toner, and a toner particle, a non-subtlety particle, and other additives are distributed independently underwater. Subsequently, a toner particle is isolated from these mixed dispersion liquid. It is separable as a water solution which contains a toner particle on a filter paper and contains a non-subtlety particle and other additives in filtrate by performing filtration actuation using the filter paper which has a moderate opening as the isolation approach, for example. Moreover, the approach of isolating a toner particle is also employable by carrying out the wet classification of the mixed dispersion liquid as other isolation approaches.

[0100] Next, the image formation approach by which the toner of this invention is applied is explained below, referring to an accompanying drawing.

[0101] Drawing 1 is color picture formation equipment (a copying machine or laser beam printer) using an electrophotography process, and a medium imprint belt is used for it.

[0102] 1 is the electrophotography photo conductor (it is described as a photoconductor drum below) of the shape of a drum as 1st image support, and revolution actuation is carried out with a predetermined peripheral velocity (process speed) in the direction of an arrow head.

[0103] A photoconductor drum 1 is a revolution process, and electrification processing is uniformly carried out to predetermined polarity and potential with the primary electrification vessel 2, and, subsequently it receives the exposure 3 by image exposure means 3 by which it does not illustrate. Thus, the electrostatic latent image corresponding to the 1st color component image (for example, yellow color component image) of the target color picture is formed.

[0104] Subsequently, the electrostatic latent image is developed with the 1st development counter (yellow color development counter 41) by the yellow component image which is the 1st color. Since the 2nd - the 4th development counter 42, i.e., a Magenta development counter, the cyanogen color development counter 43, and the black color development counter 44 do not operate and are not acting on a photoconductor drum 1 at this time, the yellow component image of the 1st color of the above is not influenced by the above 2nd - the 4th development counter.

[0105] In addition, it is desirable at the time of development that the passing speed of the toner support side in a development field is 1.05 to 3.0 times the rate of this to the passing speed of an electrostatic latent-image support side. By setting up passing speed so that it may become 1.05 to 3.0 times, the toner layer on the support of this toner will become much more good [ the faithful rendering of an electrostatic latent image ] in order to receive a moderate stirring effect.

[0106] Moreover, as for the surface roughness Ra of toner support (micrometer), in this invention, it is desirable that it is 1.5 or less. Since the count of contact of this toner support and a toner increases while controlling the toner conveyance capacity of toner support by making surface roughness Ra or less into 1.5 and carrying out lamination of the toner layer on this toner support, and the electrification nature of this toner is also improved, image quality quality improves in multiplication.

[0107] The toner thickness on toner support is regulated by specification-part material.

[0108] Toner lamination specification-part material is doctor blades which set toner support and fixed spacing and are arranged, such as a metal blade and a magnetic blade. Or the rigid-body roller and sleeve which used a metal, resin, a ceramic, etc. instead of may be used, and a magnetic generating means may be put into those interior. [ a doctor blade ]

[0109] Moreover, the elastic body like the elastic blade for carrying out toner pressure-welding spreading as specification-part material of toner lamination or an elastic roller may be used. For example, the base which is the upper edge part side of an elastic blade is fixed to a developer container, the elasticity of a blade is resisted, a variant part side is bent to the forward direction or hard flow of toner support, it changes into a condition, and a blade inner surface side (the case of hard flow outside

surface side) is made to contact a toner support front face with moderate elastic press. According to such equipment, also to environmental fluctuation, it is stable and a precise toner layer is obtained. Although the reason is not necessarily clear, since it is rubbed by this toner support front face and the compulsive target with this elastic body, it is guessed because electrification is performed in the condition same related always as change of the behavior by the environmental variation of a toner.

[0110] It is desirable to choose as this elastic body the construction material of the frictional electrification sequence which was suitable for the desired polarity to electrify a toner, and the metal elastic body like silicone rubber, polyurethane rubber, the synthetic-resin elastic body; stainless steel like the rubber elasticity object; polyethylene terephthalate like NBR, copper, and phosphor bronze can be used. Moreover, you may be those complex.

[0111] Moreover, when endurance is required of an elastic body and toner support, what was made to rival or carried out coating spreading so that a metal elastic body might be hit in resin or rubber at the sleeve contact section is desirable.

[0112] Furthermore, the organic substance and an inorganic substance may be added in an elastic body, melting mixing may be carried out, and you may make it distribute. For example, the electrification nature of a toner is controllable by adding a metallic oxide, a metal powder, the ceramics, a carbon allotrope, a whisker, an inorganic fiber, a color, a pigment, a surfactant, etc. Especially, in the case of molding objects, such as rubber and resin, also making metallic-oxide impalpable powder, such as a silica, an alumina, a titania, tin oxide, an oxidization zirconia, and a zinc oxide, carbon black, the electrification control agent generally used for a toner contain has a desirable elastic body.

[0113] Also furthermore, by impressing direct-current electric field and/or alternating current electric field to the development blade which is specification-part material, the feed roller which is feed zone material, and a brush member It unfolds, since [ to a toner ] it is an operation, it sets at least to the specification part on toner support, and improve more, set at least to a feed zone, a toner supply/Skins, and homogeneity thin layer spreading nature and homogeneity electrification nature are made more smoothly than \*\*, and can obtain achievement and the good image of sufficient image concentration.

[0114] Revolution actuation of the medium imprint belt 20 is carried out with the peripheral velocity same in the direction of an arrow head as a photoconductor drum 1.

[0115] The sequential imprint (primary imprint) of the yellow component image of the 1st color of the above formed on the photoconductor drum 1 is carried out to the peripheral face of the medium imprint belt 20 by the electric field formed of the primary imprint bias impressed to the medium imprint belt 20 from bias power supply 29 through the primary imprint roller 62 in the process in which the nip section of a photoconductor drum 1 and the medium imprint belt 20 is passed.

[0116] The front face of the photoconductor drum 1 which finished the imprint of the yellow toner image of the 1st color corresponding to the medium imprint belt 20 is cleaned by cleaning equipment 13.

[0117] Hereafter, similarly, the Magenta toner image of the 2nd color, the cyanogen toner image of the 3rd color, and the black toner image of the 4th color pile up on the medium imprint belt 20, and are imprinted one by one, and the synthetic color toner image corresponding to the target color picture is formed.

[0118] 63 is a secondary imprint roller, it corresponds to the secondary imprint opposite roller 64, carries out bearing to parallel, and is arranged in the condition that it can estrange in the underside section of the medium imprint belt 20.

[0119] The primary imprint bias for imprinting a toner image from a photoconductor drum 1 to the medium imprint belt 20 is impressed from bias power supply 29 with reversed polarity with a toner. The range of the applied voltage is +100V-+2kV.

[0120] In the primary imprint process of the toner image of the 1st - the 3rd color from the photoconductor drum 1 to the medium imprint belt 20, the secondary imprint roller 63 and the transfer residual toner electrification member 52 can also be estranged from the medium imprint belt 40.

[0121] The secondary imprint roller 63 is contacted by the medium imprint belt 20, the contact part of the medium imprint belt 20 and the secondary imprint roller 63 is fed with the imprint material P which

is the 2nd image support to predetermined timing from the feed roller 11, and the full color image imprinted on the medium imprint belt 20 is secondarily imprinted by the imprint material P by impressing secondary imprint bias to the secondary imprint roller 63 from bias power supply 28. Heating fixation of the imprint material P by which the toner image was imprinted is introduced and carried out to a fixing assembly 15.

[0122] After image imprint ending to the imprint material P, transfer residual toner cleaning equipment 50 is contacted by the medium imprint belt 20, and the front face of the medium imprint belt 20 is cleaned.

[0123] Subsequently, it is fixed to the toner image on imprint material by the heating application-of-pressure fixation means. Although the heat mechanical control by roller which considers the application-of-pressure roller of the elastic body by which the pressure welding was carried out as a heating application-of-pressure fixation means with the heating roller, this, and thrust which built in heating elements, such as a halogen heater, as a basic configuration, and the method ( drawing 2 and 3) which carries out heating fixation at a heater through a film are held, the toner of this invention shows the heating application-of-pressure fixation means like the above, and good matching.

[0124] In addition, although the image formation approach at the time of using the image formation equipment which has a medium imprint belt in the above was explained, the toner of the invention in this application can be suitably used also in the image formation equipment which does not have a medium imprint object. Moreover, the toner which cleaned, collected and collected the residual toners which are not imprinted on the electrostatic latent-image support after an imprint can be supplied to a development means, a development means can be made to be able to hold again, and it can use suitably also in the image formation equipment which has the toner reuse device in which the electrostatic latent image on electrostatic latent-image support is developed.

[0125]

[Example] Hereafter, although an example explains this invention concretely, this invention is not limited to these at all.

[0126] The example of manufacture 1 multiple-valued carboxylic-acid component of polyester resin and the polyhydric-alcohol component were adjusted so that it might become the presentation of a table 1, as a catalyst, with the dibutyl tin oxide of the 0.05 weight section of total monomer weight, it put into the separable flask of 2l. of glass, and 200 degrees C performed the esterification reaction for a thermometer, a stainless steel rabble, a flowing-down type capacitor, and nitrogen installation tubing under the nitrogen air current in installation and a mantle heater.

[0127] Furthermore, reaction temperature was raised at 230 degrees C, and it maintained at whenever [ high vacuum / of under 200 pascals (1.5mmHg) ], and the polycondensation reaction was continued, it carried out, and the polyester resin (1) of this invention was obtained.

[0128] The weighted solidity is shown in a table 2.

[0129] Polyester resin (2) - (5) was obtained like the example 1 of manufacture of polyester resin except changing as the multiple-valued carboxylic-acid component and polyhydric-alcohol component which polyester resin used example of manufacture 2-5 are shown in a table 1. The weighted solidity is summarized in a table 2.

[0130] Polyester resin (6) was obtained like the example 1 of manufacture of polyester resin except changing as the multiple-valued carboxylic-acid component and polyhydric-alcohol component which polyester resin used example of comparison manufacture 1 are shown in a table 1. The weighted solidity is summarized in a table 2.

[0131]

[A table 1]

	製造例1 ポリエステル 樹脂(1)	製造例2 ポリエステル 樹脂(2)	製造例3 ポリエステル 樹脂(3)	製造例4 ポリエステル 樹脂(4)	製造例5 ポリエステル 樹脂(5)	比較製造例1 ポリエステル 樹脂(6)
脂環式多価カルボン酸成分 (モル部)	20				20	
	1, 3-シクロヘキサジカルボン酸					
	1, 4-シクロヘキサジカルボン酸	93	48			
多価カルボン酸成分 (モル部)	1, 3, 5-シクロヘキサトリカルボン酸	7	1.5		4	
	テフタル酸			50	50	55
	イソフタル酸			49.88	10	43
	ドデセニル無水コハク酸				16	
	アジピン酸	73	50			
	トリメリット酸			0.12		2
	1, 4-シクロヘキサジメタノール	70	80	30		
脂環式多価アルコール(モル部)	水添ビスフェノールA	30	20	30		
	1, 4-シクロヘキサジオール		40		10	
	水添ビスフェノールAのエチレンオキサイド付加物(2モル付加)			30	10	
	エチレングリコール			5		
	プロピレングリコール			5		20
多価アルコール (モル部)	ビスフェノールAのエチレンオキサイド付加物(3モル付加)				40	40
	ビスフェノールAのプロピレンオキサイド付加物(3モル付加)				40	40

[0132]

[A table 2]

		GPC 測定データ	
		ピーク分子量	樹脂の酸価 (mgKOH/g)
樹脂製造例 1	ポリエステル樹脂 (1)	4000	0.02
樹脂製造例 2	ポリエステル樹脂 (2)	9000	2.0
樹脂製造例 3	ポリエステル樹脂 (3)	96000	9.0
樹脂製造例 4	ポリエステル樹脂 (4)	498000	19.7
樹脂製造例 5	ポリエステル樹脂 (5)	22000	4.0
比較樹脂製造例 1	ポリエステル樹脂 (6)	47000	3.0

酸価は、樹脂 1g 中の酸成分を中和するのに必要な水酸化カリウムの mg 数

[0133] The xylene 200 weight section was put into the glass separable flask equipped with example of manufacture 1 thermometer, the stainless steel rabble, the flowing-down type capacitor, and nitrogen installation tubing of binding resin, and temperature up was carried out to reflux temperature. Solution polymerization was completed under xylene reflux in 7 hours after dropping the mixed liquor of the styrene 80 weight section, the acrylic-acid-n-butyl 20 weight section, and the G tert-butyl peroxide 2.3 weight section at this, and the low-molecular-weight resin solution was obtained.

[0134] On the other hand, mixed suspension distribution of the styrene 65 weight section, the butyl acrylate 25 weight section, the maleic-acid monobutyl 10 weight section, the polyvinyl alcohol 0.2 weight section, the degassed water 200 weight section, and the benzoyl-peroxide 0.5 weight section was carried out. The above-mentioned suspension distribution solution was heated, under nitrogen-gas-atmosphere mind, it held at 85 degrees C for 24 hours, the polymerization was completed, and the amount resin of macromolecules was obtained.

[0135] This amount resin of macromolecules 30 weight section was supplied in the solution at the time of the solution polymerization termination containing the aforementioned low-molecular-weight resin 70 weight section, and it mixed by making it dissolving thoroughly into a solvent, and after that, the solvent was distilled off and binding resin (1) was obtained.

[0136] When this binding resin (1) was analyzed, for low-molecular-weight side peak molecular weight, 10,000 and the amount side peak molecular weight of macromolecules were [ 300,000 and the number average molecular weight (Mn) of 550,000 and weight average molecular weight (Mw) ] 55,000.

Moreover, glass transition temperature was 55 degrees C.

[0137] The xylene 200 weight section was put into the glass separable flask equipped with example of manufacture 2 thermometer, the stainless steel rabble, the flowing-down type capacitor, and nitrogen installation tubing of binding resin, and temperature up was carried out to reflux temperature. Solution polymerization was completed under xylene reflux in 7 hours after dropping the mixed liquor of the styrene 80 weight section, the acrylic-acid-n-butyl 20 weight section, and the G tert-butyl peroxide 2.3 weight section at this, and the low-molecular-weight resin solution was obtained.

[0138] On the other hand, mixed suspension distribution of the styrene 75 weight section, the butyl acrylate 25 weight section, the polyvinyl alcohol 0.2 weight section, the degassed water 200 weight section, and the benzoyl-peroxide 0.5 weight section was carried out. The above-mentioned suspension distribution solution was heated, under nitrogen-gas-atmosphere mind, it held at 85 degrees C for 24 hours, the polymerization was completed, and the amount resin of macromolecules was obtained.

[0139] This amount resin of macromolecules 30 weight section was supplied in the solution at the time of the solution polymerization termination containing the aforementioned low-molecular-weight resin 70 weight section, and it mixed by making it dissolving thoroughly into a solvent, and after that, the solvent

was distilled off and binding resin (2) was obtained.

[0140] When this binding resin (2) was analyzed, for low-molecular-weight side peak molecular weight, 12,000 and the amount side peak molecular weight of macromolecules were [ 300,000 and the number average molecular weight ( $M_n$ ) of 580,000 and weight average molecular weight ( $M_w$ ) ] 55,000. Moreover, glass transition temperature was 55 degrees C.

[0141]

[The example of manufacture of a toner]

Example of manufacture 1 and binding resin of a toner (1) The 100 weight sections and polyester resin (1) (peak molecular weight = 4000) 45 weight sections and carbon black (BET specific surface area =  $62\text{m}^2/\text{g}$ ) Ten weight sections and negative charge nature control agent (compound (I) -1) Low molecular weight polyethylene (2 weight sections and maximum endoergic peak 115 degree C) Five weight sections [0142] The above-mentioned ingredient was mixed with the blender, and after carrying out melting kneading by the 2 shaft extruder which heated this at 160 degrees C and carrying out coarse grinding of the cooled kneading object with a hammer mill, the coarse-grinding object was pulverized with the jet mill.

[0143] Subsequently, using the equipment which rotates a rotor and gives the amount of mechanical shocks, surface treatment processing was performed, the obtained particle was classified, and it considered as classification powder (A). The this classification (powder A) 100 weight section and the hydrophobic silica pulverized coal (BET specific surface area:  $220\text{m}^2/\text{g}$ ) 1.5 weight section were blended dryly with the Henschel mixer, and it considered as the toner (A) of this invention.

[0144] For 0.967 and circularity standard deviation, 0.040 and the circle equivalent number mean particle diameter  $D_1$  were [ 580,000 and the low-molecular-weight side peak molecular weight of 4.9 micrometers and the amount side peak molecular weight of macromolecules ] 11,000 whenever [ mean circle form / of a toner (A) ].

[0145] Moreover, when the with a GPC molecular weight [ in a toner ] of 1000 or less component was isolated preparatively by GPC and this was analyzed in GPC/IR,  $^1\text{H-NMR}$ ,  $^{13}\text{C-NMR}$ , and GC/MS, the content of a with a GPC molecular weight of 1000 or less which has the repeat unit of polyester system resin in structure component was 9.7 % of the weight on the basis of the toner.

[0146] Toner (B) - (E) was obtained like the example 1 of toner manufacture except changing the class of the example 2 of manufacture of a toner - 5 binding resin, the class of polyester system resin, and an addition. The class and amount of an ingredient which used, having combined with the toner (A) are shown in a table 3, and the analysis result of a toner is shown in a table 5.

[0147] In the 2l. 4 opening flask equipped with the example of manufacture 6 high-speed churning equipment TK type homomixer (special opportunity-sized industrial company make) of a toner, the ion-exchange-water 650 weight section, 0.1mol/the liter- $\text{Na}_3\text{PO}_4$  water-solution 500 weight section was supplied, the rotational frequency was adjusted to 12000rpm, and 70 degrees C was made to warm. The 1.0 mol/[l. ]- $\text{CaCl}_2$  water-solution 80 weight section was added here, and the drainage system dispersion-medium object containing a minute difficulty water solubility distribution stabilizer [a calcium phosphate salt] was prepared.

[0148] On the other hand, it is a dispersoid. - styrene 82 weight sections - 2-ethylhexyl acrylate 18 weight sections - carbon black (BET specific surface area =  $62\text{m}^2/\text{g}$ ) Ten weight sections - polyester resin (1) (peak molecular weight = 4000) Three weight sections - wax (ester wax,  $\text{mp}=76$  degree C) Seven weight sections - negative electrification nature control agent (compound (I) -1) After distributing the 2 weight sections above-mentioned mixture for 3 hours using attritor (Mitsui Mining & Smelting make), the 2 and 2'-azobis (2,4-dimethylvaleronitrile) 3 weight section was added, and the polymerization nature monomer constituent was prepared.

[0149] Next, this polymerization nature monomer constituent was thrown in in said drainage system distribution medium, maintaining the rotational frequency of a high-speed agitator to 12000rpm under nitrogen-gas-atmosphere mind with an internal temperature of 70 degrees C, it agitated for 10 minutes and this polymerization nature monomer constituent was corned. Then, having changed the agitator to the propeller impeller and agitating by 50rpm, it held at this temperature for 10 hours, and the



polymerization was completed. Suspension is cooled after polymerization termination, subsequently, dilute hydrochloric acid was added and the distributed stabilizer was made to remove. After repeating backwashing by water several times furthermore, it was made to dry and the polymer particle (F) was obtained. The weight mean diameter of this polymer particle (F) was 6.6 micrometers.

[0150] The above-mentioned polymer (particle F) 100 weight section and the hydrophobic silica pulverized coal (BET;220m<sup>2</sup>/g) 1.8 weight section were blended dryly with the Henschel mixer, and it considered as the toner (F) of this invention.

[0151] 0.988 and circularity standard deviation were [ 5.2 micrometers and the peak molecular weight of 0.025 and the circle equivalent number pitch diameter D1 ] 27,000 whenever [ mean circle form / of a toner (F) ].

[0152] Moreover, when the with a GPC molecular weight [ in a toner ] of 1000 or less component was isolated preparatively by GPC and this was analyzed in GPC/IR, 1 H-NMR, 13 C-NMR, and GC/MS, the content of a with a GPC molecular weight of 1000 or less which has the repeat unit of polyester system resin in structure component was 0.4 % of the weight on the basis of the toner.

[0153] Toner (G) - (M) was obtained like the example 6 of toner manufacture except changing the class of the example 7 of manufacture of a toner - 13 binding resin, the class of polyester system resin, and an addition. The class and amount of an ingredient which used, having combined with the toner (F) are shown in a table 4, and the analysis result of a toner is shown in a table 5.

[0154] The class of example of comparison manufacture 1 raw material of a toner and the addition presupposed that it is the same, and the toner (N) was obtained like the example 1 of toner manufacture only except changing not performing surface treatment processing. The class and amount of an ingredient which were used are shown in a table 3, and the analysis result of a toner is shown in a table 5.

[0155] Toner (O) - (Q) was obtained like the example 6 of toner manufacture except changing the class of the example 2 of comparison manufacture of a toner - 4 binding resin, the class of polyester system resin, and an addition. The class and amount of an ingredient which were used are shown in a table 4, and the analysis result of a toner is shown in a table 5.

[0156]

[A table 3]



粉砕トナーの構成成分

	製造例 1	製造例 2	製造例 3	製造例 4	製造例 5	比較 製造例 1
	トナー (A)	トナー (B)	トナー (C)	トナー (D)	トナー (E)	トナー (N)
結着樹脂(1)	100		100	100	100	100
結着樹脂(2)		100				
ポリエステル樹脂(1)	45					45
ポリエステル樹脂(2)		30				
ポリエステル樹脂(3)			1			
ポリエステル樹脂(4)				10		
ポリエステル樹脂(5)					20	
カーボンブラック	10	10	10	10	10	10
負荷電制御剤 [I]-1	2		1		1	2
負荷電制御剤 [I]-2		2	1	2		
低分子量ポリエチレン	5	5	5	5	5	5
表面改質処理	あり	あり	あり	あり	あり	なし

[0157]

[A table 4]

重合トナーの構成成分

	製造例6	製造例7	製造例8	製造例9	製造例10	製造例11	製造例12	製造例13	比較 製造例2	比較 製造例3	比較 製造例4
	トナ-(F)	トナ-(G)	トナ-(H)	トナ-(I)	トナ-(J)	トナ-(K)	トナ-(L)	トナ-(M)	トナ-(O)	トナ-(P)	トナ-(Q)
スチロ	82	77	82	85	77	77	82	82	82	82	82
2-エチルヘキシル アクリレート	18	23	18	15	23	23	18	18	18	18	18
カーボンブラック	10	10	10	10	10	10	10	10	10	10	10
ポリエステル樹脂(1)	3					10		30	0.1	135	
ポリエステル樹脂(2)		35									
ポリエステル樹脂(3)			10	25			15				
ポリエステル樹脂(4)											
ポリエステル樹脂(5)					15						
ポリエステル樹脂(6)											5
ワックス	7	7	7	7	7	7	7	7	7	7	7
負荷電制御剤 [1]-1	2	2	2	2					2	2	
負荷電制御剤 [1]-2					2	2	2	2			2
2, 2'-アビス(2, 4-ジメチルベンゾトリル)	3	3	3	3	3	3	3	3	3	3	3

[0158]

[A table 5]

	トナー 粒子	トナー中に 含有される 脂環式骨格の量 (重量部)	円相当 個数平均径 ( $\mu$ m)	平均円形度	円形度 標準偏差	円形度 0.950 未満のトナー粒子 (個数%)	GPC分子重 1000以下の 成分量 (%) * 1
製造例 1	(A)	8.5	4.9	0.967	0.040	25	9.7
製造例 2	(B)	8.9	5.8	0.954	0.040	29	4.3
製造例 3	(C)	0.3	6.5	0.955	0.039	27	0.1
製造例 4	(D)	1.5	6.4	0.961	0.038	24	0.1
製造例 5	(E)	1.0	6.8	0.957	0.038	22	1.1
製造例 6	(F)	0.7	5.2	0.988	0.025	6	0.4
製造例 7	(G)	9.8	5.7	0.981	0.028	8	5.0
製造例 8	(H)	2.8	5.8	0.987	0.019	3	0.5
製造例 9	(I)	6.3	6.0	0.975	0.027	10	1.2
製造例 10	(J)	0.7	6.0	0.980	0.023	9	0.9
製造例 11	(K)	2.3	5.8	0.993	0.002	3	2.3
製造例 12	(L)	4.1	5.7	0.984	0.024	7	0.8
製造例 13	(M)	6.0	5.5	0.981	0.022	7	6.2
比較製造例 1	(N)	8.5	5.0	0.932	0.048	43	10.1
比較製造例 2	(O)	0.03	5.2	0.983	0.025	9	0.1
比較製造例 3	(P)	16.1	6.8	0.968	0.041	15	12.6
比較製造例 4	(Q)	—	5.6	0.979	0.028	6	0.4

\* 1: ポリエステル系樹脂の繰返し単位を構造中に含有する成分。

[0159] Examples 1-13 and the [examples 1-4 of comparison] above-mentioned toner (A) It evaluated using - (Q) as follows.

[0160] First, in the image formation equipment shown in drawing 1, it set up so that the passing speed of a toner support side might become 150% to the passing speed of an electrostatic latent-image support side.

[0161] Next, after rotating a development counter, the image was made to print out without being respectively filled up with toner (A) - (Q) in a development counter, equipping the driving gear of the development counter with which the electrostatic latent-image support set up so that the peripheral velocity of the toner support side of this development counter might become a second in 180mm /is not

arranged, and carrying out 25 minute room copy paper under ordinary temperature normal relative humidity.

[0162] Toner (A) - (Q) was performed at the print-out rate for 20-sheet/(A4 size) under ordinary temperature normal relative humidity (25 degrees C, 60%RH), high-humidity/temperature (30 degrees C, 80%RH), and a low-humidity/temperature (15-degree-C, 10%RH) environment, and the print-out trial of 20,000 sheets was performed by the continuous mode (namely, mode in which consumption of a toner is promoted without stopping a development counter) in monochrome. And the obtained print-out image was evaluated about the below-mentioned item.

[0163] The fixing assembly made heater laying temperature of a fixing assembly 15 170 degrees C, and set nip between rollers to 9mm.

[0164] Furthermore, it evaluated after print-out test termination also about matching with the image formation equipment and the above-mentioned toner which were used.

[0165] In addition, the surface roughness of the toner support used here is 1.5, and the construction material of a toner regulation blade is stainless steel.

[0166] [Print-out image assessment]

(1) The image concentration maintenance at the time of print-out termination of 20,000 sheets estimated in the image concentration usual regular paper for copying machines (75 g/m<sup>2</sup>). In addition, image concentration measured relative concentration [ as opposed to the print-out image of the white part of 0.00 in manuscript concentration ] using the "Macbeth reflection density meter" (made in Macbeth).

A (A) More than :1.40B (good) : 1.35 or more, less than 1.40C (good) : 1.00 or more and less than [ less than 1.35 ] D (improper):1.00 [0167] (2) Viewing estimated the inside omission (condition of drawing 4 (b)) of the alphabetic character at the time of printing the "\*\*\*" character pattern shown in inside omission drawing 4 (a) on cardboard (135 g/m<sup>2</sup>).

A: It is very fitness (it hardly generates).

B: Good (slight)

C: Practical use good D : practical use is impossible. (remarkable)

[0168] (3) From the difference of the whiteness degree of the white part of the print-out image measured by image fogging "RIFUREKUTO meter" (Tokyo Denshoku Co., Ltd. make), and the whiteness degree of a transfer paper, fogging concentration (%) was computed and image fogging was evaluated.

A: It is very fitness (less than 1.5%).

B: Good (1.5% or more, less than 2.5%)

C: Practical use is possible. (2.5% or more, less than 4.0%)

D: Practical use is impossible. (4% or more)

[0169] [Image formation equipment matching assessment]

Viewing estimated the situation of fixing of the residual toner to a development sleeve front face after matching print-out test termination with <1> development sleeve.

A: non-generated B: -- almost -- not generating -- C: -- [0170] with much D:fixing with some fixing

Viewing estimated the generating situation of fixing of the blemish of a photo conductor drum front face, or a residual toner after matching print-out test termination with <2> photoconductor drums.

A: Un-generating [ B ]. : [0171] with much C:fixing as which generating of a blemish is regarded slightly and D:fixing with a blemish Viewing estimated the fixing situation of the blemish of a medium imprint body surface, or a residual toner after matching print-out test termination with <3> medium imprint belt.

A: Un-generating [ B ]. : [0172] with much C:fixing existence of a residual toner is accepted to be to a front face and D:fixing with a blemish Viewing estimated the fixing situation of the blemish of a fixation film front face, or a residual toner after matching print-out test termination with <4> anchorage devices.

A: Un-generating [ B ]. : summarize an assessment result with much C:fixing as which fixing is regarded slightly and D:fixing with a blemish in a table 6 and a table 7.

[0173]

[A table 6]

プリントアウト画像評価結果

	トナー No	常温常湿			低湿低湿			高温高湿		
		画像 濃度	中抜け	カブリ	画像 濃度	中抜け	カブリ	画像 濃度	中抜け	カブリ
実施例 1	(A)	A	B	A	A	B	C	B	C	B
実施例 2	(B)	A	B	B	A	B	B	B	B	B
実施例 3	(C)	A	C	B	B	C	C	B	C	C
実施例 4	(D)	A	B	B	B	B	C	B	B	C
実施例 5	(E)	A	B	C	B	C	B	B	C	B
実施例 6	(F)	A	B	B	A	B	A	A	A	B
実施例 7	(G)	A	A	A	A	A	A	A	A	A
実施例 8	(H)	A	A	A	A	B	B	A	A	A
実施例 9	(I)	A	A	B	A	B	B	B	B	B
実施例 10	(J)	A	A	A	A	C	B	A	B	C
実施例 11	(K)	A	A	A	A	B	B	A	B	A
実施例 12	(L)	A	A	A	A	A	A	A	A	A
実施例 13	(M)	A	A	A	A	B	A	A	A	B
比較例 1	(N)	A	B	C	B	C	C	B	C	C
比較例 2	(O)	B	B	C	B	B	C	B	B	B
比較例 3	(P)	B	C	B	B	C	C	C	C	C
比較例 4	(Q)	B	B	C	C	C	C	C	C	C

[0174]

[A table 7]

画像形成装置とのマッチング

	トナーNo	スリーブ	感光ドラム	中間転写ベルト	定着装置
実施例 1	(A)	A	B	B	B
実施例 2	(B)	A	B	B	B
実施例 3	(C)	B	C	C	A
実施例 4	(D)	A	B	B	B
実施例 5	(E)	A	B	B	B
実施例 6	(F)	A	B	B	A
実施例 7	(G)	A	A	A	B
実施例 8	(H)	B	B	B	B
実施例 9	(I)	A	B	A	B
実施例 10	(J)	A	B	B	B
実施例 11	(K)	A	A	A	A
実施例 12	(L)	A	B	A	B
実施例 13	(M)	A	A	A	A
比較例 1	(N)	C	C	C	C
比較例 2	(O)	C	C	B	B
比較例 3	(P)	B	C	C	C
比較例 4	(Q)	C	C	C	C

[0175] The image formation equipment used for this example is explained. In this example, commercial laser beam printer LBP-PX (Canon make) was converted and used for nonmagnetic 1 component development.

[0176] The equipment of the reversal development which develops the negative (negative polarity) latent image on a photo conductor using a negative (negative polarity) toner is made into an example, and this example explains it.

[0177] Drawing 5 is the rough explanatory view of the cross section of the laser beam printer applied to this invention.

[0178] The OPC photo conductor drum 110 (diameter of 24mm) rotates in the direction of an arrow head, and it is charged in homogeneity so that dark space potential ( $V_d$ ) may be set to -600V with the electrification roll 111. Next, exposure is performed in the image section by the aligner 114, and the electrostatic latent image whose bright section potential ( $V_l$ ) is -150V is formed. Having set the gap (300 micrometers) as non-contact for the developer layer on the toner support 117 which has the photo conductor drum 110 and the toner spreading roller 116, and impressing AC bias ( $f=1800\text{Hz}$ ,  $V_{pp}=1400\text{V}$ ) and direct-current bias ( $V_{dc}=-400\text{V}$ ) to the toner support 117 with the bias impression means V, the image section was developed by NEGATONA and the toner image was formed in photo conductor drum lifting. The toner which imprinted the toner on record material with the transfer roller 119, and remained this obtained toner image on the photo conductor front face is cleaned with a cleaner 113. On the other hand, since the toner image on the record material P is established with the heating anchorage device H, heating fixation processing of the record material P separated from the photo conductor drum 110 is carried out. The above process is repeated and image formation is performed. At this time, the total pressure between 190 degrees C and the heating object 31-application-of-pressure roller 33 set nip of 6kg, an application-of-pressure roller, and a film to 3mm, and the skin temperature of 31d of thermometry components of the heating object 31 of the heating anchorage device H used the heat-resistant polyimide film with a thickness of 50 micrometers which has the mold release layer of the

low resistance which made the contact surface with record material distribute conductive material to PTFE for the fixation film 32.

[0179] The above condition, under ordinary temperature normal relative humidity (25 degrees C, 60% RH), high-humidity/temperature (30 degrees C, 80%RH), and a low-humidity/temperature (15-degree-C, 10%RH) environment, the rear-spring-supporter print-out trial was continuously performed to 5000 sheets, supplying the toner concerning this invention, and the toner for a comparison at the print-out rate for six-sheet/(A4 size), and the obtained image was evaluated about the following item.

[0180] In addition, the surface roughness Ra of the toner support used here is 1.5, and the construction material of a toner regulation blade is stainless steel.

[0181] Based on above-mentioned evaluation criteria and an above-mentioned valuation basis, matching with image assessment and image formation equipment was evaluated.

[0182] An assessment result is summarized in tables 8 and 9.

[0183]

[A table 8]

プリントアウト画像評価結果

	トナー No	常温常湿			低温低湿			高温高湿		
		画像濃度	中抜け	カブリ	画像濃度	中抜け	カブリ	画像濃度	中抜け	カブリ
実施例 14	(B)	A	B	B	A	B	B	B	B	B
実施例 15	(G)	A	A	A	A	A	A	A	A	A
実施例 16	(L)	A	A	A	A	A	A	A	A	A
実施例 17	(M)	A	A	A	A	B	A	A	A	B
比較例 5	(N)	B	B	B	B	C	C	B	C	C
比較例 6	(Q)	B	C	C	C	C	C	B	C	C

[0184]

[A table 9]

画像形成装置とのマッチング

	トナーNo	スリーブ	感光ドラム	定着装置
実施例 14	(B)	B	B	B
実施例 15	(G)	A	A	A
実施例 16	(L)	A	B	B
実施例 17	(M)	A	A	A
比較例 5	(N)	C	C	C
比較例 6	(Q)	B	B	C

[0185]

[Effect of the Invention] As mentioned above, according to this invention, it excels in electrophotographic properties under which environment, a high definition image is given, it excels in environmental stability, and the contamination to a developer attachment component, a photo conductor, a fixing assembly, etc. can also offer few toners and the image formation approach.

[Translation done.]